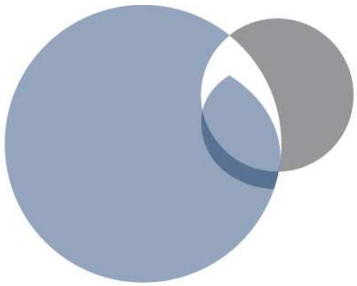
This course has been developed under

RoNoMar - Romanian Norwegian Maritime Project

(2008/111922)



Supported by a grant from Norway through the Norwegian Cooperation Programme for Economic Growth and Sustainable Development with Romania.

1. Introduction and safety

1.1 Introduction

The course aims are to provide the training for candidates to launch and take charge of a survival craft or rescue boat in emergency situations, in accordance with Section A-VI/2 of the STCW Code.
This course is both practical and theoretical, after the theoretical lessons conducted by following the practical applications of craft and their accessories. Instructors will provide the necessary theoretical and practical applications to perform and will oversee the entire progress of the exercise.

At the end of the course, students will gain extra experience in terms of proficiency in survival craft and rescue boats other than fast rescue boats and will be better-integrated teamwork intervention in case of emergency.
The syllabus covers the requirements of the 1995 STCW Convention Chapter VI, Section VI/2, Table A-VI/2-1.

Students will gain knowledge on:

- Preparation and launching of survival craft
- Use of equipment
- Operation rescue boat engine
- Crew management and craft after abandoning ship
- Use of signaling equipment and GMDSS equipment
- First aid medical survivors
- Actions taken for survival in rescue boat

1.2 Safety guidance

During the training time, the trainees must follow the safety rules teach by instructors or experts, mostly during practical period when the saving equipment are used.

The orders “STILL” and “CARRY ON” must be strictly respected during all period of training with the watercrafts from training base.

2. General

2.1 Emergency situation

2.1.1 Types of emergency

Without to limit of these, the most common of emergency situation are:

- *Fire* (Accommodation fire, Galley fire, Engine room fire, Cargo hold fire, Cargo fire on deck, Pump room fire, Emergency generating room fire).
- *Abandon ship.*

- *Damage to ship* (Collision, Grounding, Flooding, Main engine failure, Steering gear failure, Black out, Tank explosion, Tank leakage (in double bottoms, side spaces, cofferdams, etc)).
- *Personal Accidents* (Man overboard, Rescue from enclosed space).
- *Unlawful Acts* (Pirate attack).
- *Emergency Assistance to Other Ships* (Rescue at sea)..
- *Cargo Related Accidents* (Hose burst or Cargo overflow, break away from jetty during cargo transfer, Toxic liquid release at sea or at anchor, Toxic liquid release at terminal, Cargo jettisoning, Gas release at sea or at anchor, Gas release at terminal).
- *Pollution* (Bunker spills, Sea pollution).
- *Terrorist boarding*
- *Loosing of ship's stability*
- *Bad weather* (heavy gale, icing).

Fire/Explosion can arise due to failure or faulty operation of equipment, by self-ignition caused by carelessness with open fire or smoking in the bunk.

Collision can be caused by failure of machinery or rudder, insufficient watchkeeping or navigation faults.

Grounding or *stranding*, like collision can be caused by navigation faults, failure of machinery or rudder, bad weather or the ship's anchors dragging.

Leakage occurs, when the ship's hull, deck or hatches are damaged.

Icing can be dangerous for smaller vessel. It reduce the stability of the vessel, possibly resulting in capsizing.

Man over board : to rescue a person fallen overboard safely on board again, a last and efficient action is required by the crew.

All the above emergencies present danger to human lives, most of them eventually can lead to the abandoning and loss of the ship.

A happy ending of an emergency implies that you must perform your duties with responsibility and care.

The life saving equipment must be ready to use at any time.

There are some situations when the life saving equipment as life boats or fast rescue boats must be lowered at sea: abandon ship, man over board, towing and rescue the survival craft from a sea or/and from a ship's wreck.

On different emergency situations may appear difficulties to abandon ship, as blocking of evacuation ways, impossibility to lowering of boats or rafts (excessive list of the ship, damages, failures, etc), lack of lighting, lack of the crew members with duties regarding boats/ rafts launching, very bad weather, etc.

In case of fire is safe to launch only a part of survival boats/rafts, for being on "stand by", while the fighting against fire must be continued.

2.1.2 Emergency signals and public address system

The **general emergency alarm system** is capable of sounding the general alarm signal consisting of seven or more short blasts followed by one long blast on the vessel's whistle or siren and additionally on an electrically operated bell or klaxon or other equivalent warning system which shall be powered by means of two circuits, one from the ship's main supply and the other from the emergency source of electrical power.

The general emergency alarm system is to be supplemented by either a public address system or other suitable means of communication.

The entertainment sound system is to be automatically turned off when the general alarm system is activated.

The system is to be continuously powered and is to have an automatic change-over to a standby power supply in case of loss of the normal power supply.

An alarm is to be given in the event of failure of the normal power supply.

The system is to be capable of operation from the navigation bridge and, except for the ship's whistle, also from other strategic points.

The alarm system is to be audible throughout all the accommodation and normal crew working spaces and on all open decks.

The minimum sound pressure level for the emergency alarm tone in interior and exterior spaces is to be 80 dB (A) and at least 10 dB (A) above ambient noise levels existing during normal equipment operation with the ship underway in moderate weather.

Every day the test of General emergency system and Public address system must be done and the note must be inserted into the Log Book.

The **public address system** is to be one complete system consisting of a loudspeaker installation which enables simultaneous broadcast of messages from the navigation bridge, and at least one other location on board for use when the navigation bridge has been rendered unavailable due to the emergency, to all spaces where crew members or passengers, or both, are normally present (accommodation and service spaces and control stations and open decks), and to assembly stations (i.e. muster stations).

In spaces such as under deck passageways, busun's locker, hospital and pump room, the public address system is/may not be required.

The public address system is to be arranged to operate on the main source of electrical power, the emergency source of electrical power and transitional sources of electrical power.

The controls of the system on the navigation bridge are to be capable of interrupting any broadcast on the system from any other location on board.

The system is to be arranged to minimise the effect of a single failure so that the emergency messages are still audible (above ambient noise levels) also in the event of failure of any one circuit or component.

The **combined** General emergency alarm - Public address system: where the public address system is the only means for sounding the general emergency alarm signal and the fire alarm, the following are to be satisfied:

- the system automatically overrides any other input system when an emergency alarm is required.
- the system automatically overrides any volume control provided to give the required output for the emergency mode when an emergency alarm is required.
- the system is arranged to minimize the effect of a single failure so that the alarm signal is still audible (above ambient noise levels) also in the event of failure of any one circuit or component, by means of the use of more than one device for generating an electronic sound signal.

Fig.2.1 Public Address System and General alarm panel

EMERGENCY SIGNALS

EMERGENCY SIGNAL = continuous blast of the whistle for a period of not less than 10 seconds, supplemented by the continuous ringing of the general alarm bells for not less than 10 seconds. ▬▬▬▬

ABANDON SHIP SIGNAL = a succession of seven or more short blasts followed by one long blast of the whistle supplemented by a comparable signal on the general alarm bells. ● ● ● ● ● ● ● ▬▬▬

ABANDON signal MUST always be confirmed by word from the Master.

HANDLING THE LIFEBOATS:

- To lower lifeboats, *one short blast.*
- To stop lowering the lifeboats, *two short blasts*.
- Dismissal from boat station, *three short blast*

The emergency signals from the alarm bells could be verbally confirmed by the duty officer using the amplifier station/public address system.

The signals should be repeated few times, with a long enough pause in between in order not to create confusion.

2.1.3 Muster List

Regulation 37 *(1974, SOLASConvention):* Muster list and emergency instructions

In order to cope an emergency situation in the best way it is necessary having planned ahead. The plan are called **the Muster List** and all vessels shall be provided with this clear instructions for each crew member, which shall be followed in case of emergency.

The muster list shall be posted up in several parts of the vessel and, in particular, in the wheelhouse, the engine room and in the crew accommodation and shall include the information specified in the following paragraphs.

The muster list shall specify details of the general alarm signal and also the action to be taken by the crew when this alarm is sounded.

The muster list shall also specify how the order to abandon ship will be given.

The muster list shall show the duties assigned to the different members of the crew including:

a) closing of watertight doors, fire doors, valves, scuppers, overboard shoots, side scuttles, skylights, portholes and other similar openings in the vessel;

b) equipping the survival craft and other life-saving appliances;

c) preparation and launching of survival craft;

d) general preparation of other life-saving appliances;

e) use of communication equipment; and

f) manning of fire parties assigned to deal with fires.

g) muster of passengers

h) use of communication equipment

i) special duties assigned in respect of the use of fire-fighting equipment and installations.

The muster list shall specify which officers are assigned to ensure that the life-saving and fire appliances are maintained in good condition and are ready for immediate use.

The muster list shall specify substitutes for key persons who may become disabled, taking into account that different emergencies may call for different actions.

The muster list shall be prepared before the vessel proceeds to sea. After the muster list has been prepared, if any change takes place in the crew, which necessitates an alteration in the muster list, the skipper shall either revise the list or prepare a new list.

The master shall ensure that:

- copies of the muster list are exhibited in conspicuous places throughout the ship including the navigating bridge, engine-room and crew accommodation spaces;
- clear instructions to be followed in the event of an emergency are provided for every person on board; and
- illustrations and instructions in English and in any other appropriate language are posted in passenger cabins and conspicuously displayed at muster stations and other passenger spaces to inform passengers of:
  - their muster stations;
  - the essential action they must take in an emergency;
  - the method of donning life-jackets.

The muster list shall show the duties assigned to members of the crew in relation to passengers in case of emergency, these duties shall include:

- warning the passengers;
- seeing that they are suitably clad and have donned their life-jackets correctly;
- assembling passengers at muster stations;
- keeping order in the passageways and on the stairways and generally controlling the movements of the passengers.
- ensuring that a supply of blankets is taken to the survival craft.

Live Saving Appliance I.M.O. Signs

Recommended symbol indicating the location of emergency equipment and muster and embarkation stations

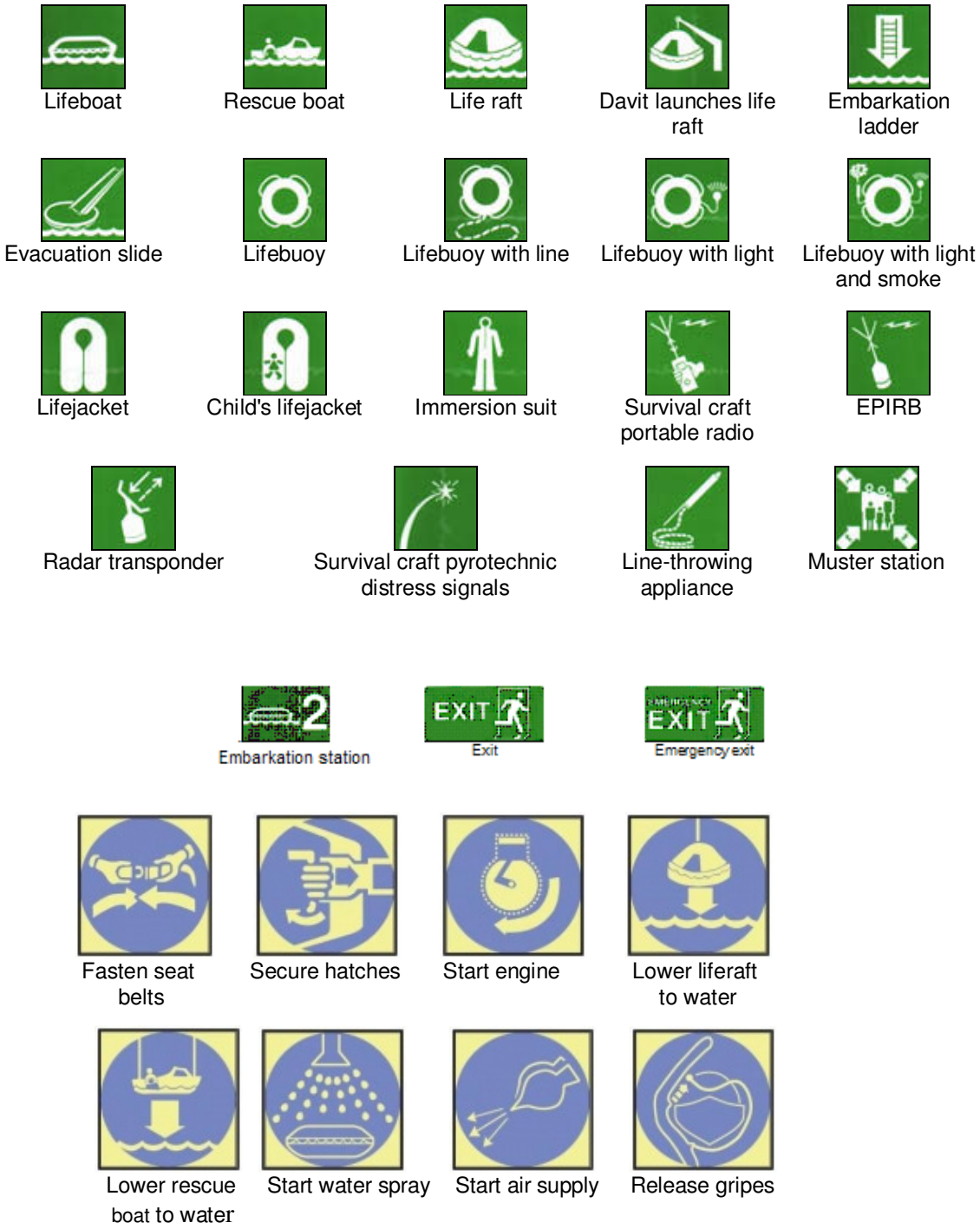


Fig.2.2 I.M.O. signs regarding life saving appliances

2.2 Training, drills and operational readiness

2.2.1 On board training and instructions

Onboard training in the use of the vessel's lifesaving appliances, including survival craft equipment, should be given as soon as possible but not later than 2 weeks after a crew member joins the vessel. However, if the crew member is on a regularly scheduled rotating assignment to the vessel, such training should be given not later than 2 weeks after the time of first joining the vessel.

Instructions in the use of the vessel's lifesaving appliances and in survival at sea should be given at the same intervals as the drills. Individual instruction may cover different parts of the vessel's lifesaving system, but all the vessel's lifesaving equipment and appliances should be covered within any period of 2 months.

Each member of the crew should be given instructions which should include but not necessarily be limited to:

- operation and use of the vessel's inflatable life rafts, including precautions concerning nailed shoes and other sharp objects;
- problems of hypothermia, first aid treatment for hypothermia and other appropriate first aid procedures;
- special instructions necessary for use of the vessel's lifesaving appliances in severe weather and severe sea conditions.

Onboard training in the use of davit launched life rafts should take place at intervals of not more than 4 months on every vessel fitted with such appliances. Whenever practicable this should include the inflation and lowering of a life raft.

This life raft may be a special life raft intended for training purposes only, which is not part of the vessel's lifesaving equipment; such a special life raft should be conspicuously marked.

Regulation 19 (1974, SOLAS Convention): Emergency training and drills

19.1 *: This regulation applies to all ships.*

19.2 *: Familiarity with safety installations and practice musters*

19.2.1 : Every crew member with assigned emergency duties shall be familiar with these duties before the voyage begins.

19.2.2 : On a ship engaged on a voyage where passengers are scheduled to be on board for more than 24 hours, musters of the passengers shall take place within 24 hours after their embarkation. Passengers shall be instructed in the use of the lifejackets and the action to take in an emergency.

19.3 *: Drills*

19.3.1 : Drills shall, as far as practicable, be conducted as if there were an actual emergency.

19.3.2 : Every crew member shall participate in at least one abandon ship drill and one fire drill every month. The drills of the crew shall take place within 24 h of the ship leaving a port if more than 25 % of the crew have not participate in

abandon ship and fire drills on board that particular ship in the previous month. When a ship enters service for the first time, after modification of a major character or when a new crew is engaged, these drills shall be held before sailing. The Administration may accept other arrangements hat are at least equivalent for those classes of ships for which this is impracticable.

19.3.3 : Abandon ship drill

Each abandon ship drill shall include:

* summoning of passengers and crew to muster stations with the alarm followed by drill announcement on the public address or other communication system and ensuring that they are made aware of the order to abandon ship;
* reporting to stations and preparing for the duties described i the muster list;
* checking that passengers and crew are suitably dressed;
* checking that lifejackets are correctly donned;
* lowering of at least one lifeboat after any necessary preparation for launching;
* starting and operating the lifeboat engine;
* operation of davits used for launching liferafts;
* a mock search and rescue of passengers trapped in their state rooms;
* instructions in the use of radio life-saving appliances.

19.3.4 Fire drills

Each fire drill shall include:

* reporting to stations and preparing for the duties described in the muster list ;
* starting of a fire pump, using at least the two required jets of water to show that the system is in proper working order;
* checking of fireman's outfit and other personal rescue equipment;
* checking of relevant communication equipment;
* checking the operation of watertight doors, fire doors, fire dampers and main inlets and outlets of ventilation systems in the drill area;
* checking the necessary arrangements for subsequent abandoning of the ship.

The equipment used during drills shall immediately be brought back to its fully operational condition and any faults and defects discovered during the drills shall be remedied as soon as possible.

19.4 *Records*

The date when musters are held, details of abandon ship drills and fire drills, drills of other life-saving appliances and on-board training should be recorded in such logbook as may be prescribed by the competent authority.

If a full muster, drill or training session is not held at the appointed time, an entry should be made in the logbook stating the circumstances and the extent of the muster, drill or training session held.

Regulations 20 (1974, SOLAS Convention): Operational readiness, maintenance and inspections

20.1 *This regulation applies to all ships*

20.2 *Operational readiness*

Before the ship leaves port and at all times during the voyage, all life-saving appliances shall be in working order and ready for immediate use.

20.3 *Maintenance*

Instructions for on-board maintenance of life-saving appliances complying with the requirements of regulation 36 shall be provided and maintenance shall be carried out accordingly.

The Administration may accept, in lieu of the instructions required by above paragraph, a shipboard planned maintenance programme which includes the requirements of the Training Manual.

20.4 *Maintenance of falls*

Falls used in launching shall be turned end for end at intervals of not more than 30 months and be renewed when necessary due to deterioration of the falls or at intervals of not more than five years, whichever is the earlier.

The Administration may accept in lieu of the "end for ending" required in above paragraph, periodic inspection of the falls and their renewal whenever necessary due to deterioration or at intervals of not more than four years, whichever one is earlier.

20.5 *Spares and repair equipment*

Spares and repair equipment shall be provided for life-saving appliances and their components which are subject to excessive wear or consumption and need to be replaced regularly.

20.6 *Weekly inspection*

All survival craft, rescue boats and launching appliances shall be visually inspected to ensure that they are ready for use.

All engines in lifeboats and rescue boats shall be run for a total period of not less than 3 min provided the ambient temperature is above the minimum temperature required for starting and running the engine. During this period of time, it should be demonstrated that the gear box and gear box train are engaging satisfactorily. If the special characteristics of an outboard motor

fitted to a rescue boat would not allow it to be run other than with its propeller submerged for a period of 3 min, it should be run for such period as prescribed in the manufacturer's handbook.

The general emergency alarm system shall be tested.

20.7 *Monthly inspections*

Inspection of the life-saving appliances, including lifeboat equipment, shall be carried out monthly using the checklist required by the Training Manual to ensure that they are complete and in good order. A report of the inspection shall be entered in the log-book.

20.8 *Servicing of inflatable liferafts, inflatable lifejackets, marine evacuation systems, and inflated rescue boats*

Every inflatable liferaft, inflatable lifejacket, and marine evacuation system shall be serviced:

- at intervals not exceeding 12 months, provided where in any case this is impracticable, the Administration may extend this period to 17 months.
- at an approved servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.

20.9 *Periodic servicing of hydrostatic release*

Every hydrostatic release shall be serviced:

- at intervals not exceeding 12 months. The Administration may extend this period to 17 months, in cases where if appears proper and reasonable.
- at a servicing station which is competent to service it, maintains proper servicing facilities and uses only properly trained personnel.

Regulation 36 (1974, SOLAS Convention): Instructions for on-board maintenance

Instructions for on-board maintenance of life-saving appliances shall be easily understood, illustrated wherever possible, and, as appropriate, shall include the following for each appliance:

* a check list for use when carrying out the inspections required by Regulations;
* maintenance and repair instructions;
* schedule of periodic maintenance;
* diagram of lubrication points with recommended lubricants;
* list of replaceable parts;
* list of sources of spare parts;
* log for record of inspection and maintenance.

2.2.2 Training manual

Regulation 35 (1974, SOLAS Convention) : Training manual and on-board training aids

Each ship shall carry a training manual, which may comprise several volumes, shall contain instructions and information, in easily understood terms illustrated wherever possible, on the life-saving appliances provided in the ship and on the best methods of survival.

Any part of such information may be provided in the form of audio visual aids in lieu of the manual.

The following shall be explained in detail:

- donning of lifejackets, immersion suits, thermal protective aids, anti-exposure suits;
- muster at the assigned stations;
- boarding, launching and clearing the survival craft and rescue boats;
- method of launching from within the survival craft;
- release from launching appliances;
- methods and use of devices for protection in launching areas where appropriate;
- illumination in launching areas;
- use of survival equipment;
- use of detection equipment;
- with the assistance of illustrations, the use of radio-saving appliances;
- use of drogues;
- use of engine and accessories;
- recovery of survival craft and rescue boats including stowage and securing;
- hazards of exposure and the need for warm clothing;
- best use of survival craft facilities in order to survive;
- methods of retrieval, including use of helicopter rescue gear (slings, baskets, stretchers) and shore life-saving apparatus and ship's line throwing apparatus;
- all other functions contained in the muster list and emergency instructions;
- instructions for emergency repair of the life-saving appliances.

2.3 Actions to be taken when called to survival craft stations

2.3.1 Definitions as per Life Saving Appliances Code (L.S.A. Code)

Regulation 3 (1974, SOLAS Convention): Definitions

* *Anti-exposure suit* is a protective suit designed or use by rescue boat crews and marine evacuation system parties.

* *Certificated person* is a person who holds a certificate of proficiency in survival craft issued under the authority of, or recognized as valid by, the

Administration in accordance with the requirements of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, in force; or a person who holds a certificate issued or recognized by the Administration of a State not a Party to that Convention for the same purpose as the convention certificate.

* *Embarkation ladder* is the ladder provided at survival craft embarkation stations to permit safe access to survival craft after launching.

* *Float-free launching* is that method of launching a survival craft whereby the craft is automatically released from a sinking ship and is ready for use.

* *Free-fall launching* is that method of launching a survival craft whereby the craft with its complement of persons and equipment on board is released and allowed to fall into the sea without any restraining apparatus.

* *Immersion suit* is a protective suit which reduces he body heat loss of a person wearing it in cold water.

* *Inflatable appliance* is an appliance which depends upon non-rigid, gas filled chambers for buoyancy and which is normally kept uninflated until ready for use.

* *Inflated appliance* is an appliance which depends upon non-rigid, gas filled chambers for buoyancy and which is kept inflated and ready for use at all times.

* *International Life-Saving Appliance* (LSA) Code means the International Life-Saving Appliance (LSA) Code adopted by the Maritime Safety Committee of the Organization by resolution MSC.48(66).

* *Launching appliance* or arrangement is a means of transferring a survival craft or rescue boat from its stowed position safely to the water.

* *Marine evacuations* system is an appliance for the rapid transfer of persons from the embarkation deck of the ship to a floating survival craft.

* *Rescue boat* is a boat designed to rescue persons in distress and to marshal survival craft.

* *Survival craft* is a craft capable of sustaining the lives of persons in distress from the time of abandoning the ship.

* *Thermal protective aid* is a bag or suit made of waterproof material with low thermal conductance.

2.3.2 Personal life-saving appliances

Chapter II (L.S.A.Code)

* *Lifebuoys*

- have an outer diameter of not more than 800 mm and an inner diameter of not less than 400 mm;
- be capable of supporting not less than 14.5 kg of iron in fresh water for a period of 24 h;
- have a mass of not less than 2.5 kg;
- not sustain burning or continue melting after being totally enveloped in a fire for a period a 2 s;
- if it is intended to operate the quick-release arrangement provided for the self-activated smoke signals and self-igniting lights, have a mass sufficient to operate the quick-release arrangement;

- be fitted with a grabline not less than 9.5 mm in diameter and not less than four times the outside diameter of the body of the buoy in length.

Fig.2.3 Life buoys and lifebuoy's lights

Self-igniting lights of the lifebuoy shall:

- be such that they cannot be extinguished by water;
- be of white color and capable of either burning continuously with a luminous intensity of not less than 2 cd in all directions of the upper hemisphere or flashing (discharge flashing) at a rate of not less than 50 flashes and not more than 70 flashes per min with at least the corresponding effective luminous intensity;
- be provided with a source of energy capable of meeting the requirement of previous paragraph for a period of at least 2 hours;
- be capable of withstanding the drop test into the water from the height at which it is stowed above the waterline in the lightest seagoing condition or 30 m, whichever is the greater, without impairing either its operating capability or that of its attached components.

Self-activating smoke signals shall**:**

- emit smoke of a highly visible color at a uniform rate for a period of at least 15 min when floating in calm water;
- not ignite explosively or emit any flame during the entire smoke emission time of the signal;
- not be swamped in a seaway;
- continue to emit smoke when fully submerged in water for a period of at least 10 s;
- be capable of withstanding the drop test into the water from the height at which it is stowed above the waterline in the lightest seagoing condition or

30 m, whichever is the greater, without impairing either its operating capability or that of its attached components

Fig. 2.4 "Man over board " smoke and lights buoy

* *Lifejackets*

- a lifejacket shall not sustain burning or continue melting after being totally enveloped in a fire for a period of 2 s;
- after demonstration, all persons can correctly don it within a period of 1 min without assistance;
- it is clearly capable of being worn in only one way or, as far as is practicable cannot be donned incorrectly;
- it allows the wearer to jump from a height of at least 4.5 m into the water without injury and without dislodging or damaging the lifejacket;
- lift the mouth of an exhausted or unconscious person not less than 120 mm clear of the water with the body inclined backwards at an angle of not less than 20' from the vertical position;
- an adult lifejacket shall allow the person wearing it to swim a short distance and to board a survival craft.
- a lifejacket shall have buoyancy which is not reduced by more than 5% after2 4 h submersion in fresh water.

Fig.2.5 Lifejacket and lifejacket light

Life-jacket light shall:

- have a luminous intensity of not less than 0.75 cd in all directions of the upper hemisphere;
- have a source of energy capable of providing a luminous intensity of 0.75 cd for a period of at least 8 hours;
- be visible over as great a segment of the upper hemisphere as is practicable when attached to a lifejacket;
- be of white color.

If the light referred above is a flashing light it shall, in addition:

- be provided with a manually operated switch; and
- flash at a rate of not less than 50 flashes and not more than 70 flashes per min with an effective luminous intensity of at least 0.75 cd.

* *Inflatable lifejackets*

- a lifejacket which depends on inflation for buoyancy shall have not less than two separate compartments and comply with the all requirements for ordinary lifejacket, and shall:
- inflate automatically on immersion, be provided with a device to permit inflation by a single manual motion and be capable of being inflated by mouth;
- in the event of loss of buoyancy in any one compartment be capable of complying with the all requirements for ordinary lifejacket;
- shall have buoyancy which is not reduced by more than 5% after 24h submersion in fresh water after inflation by means of the automatic mechanism.

Fig. 2.6 Inflatable lifejacket

* *Immersion suits*

- It can be unpacked and donned without assistance within 2 min, taking into account any associated clothing and a lifejacket if the immersion suit is to be worn in conjunction with a lifejacket;

- It will not sustain burning or continue melting after being totally enveloped in a fire for a period of 2 s;
- It will cover the whole body with the exception of the face; hands shall also be covered unless permanently attached gloves are provided;
- It is provided with arrangements to minimize or reduce free air in the legs of the suit;
- Jump from a height of not less than 4.5 m into the water with out damaging or dislodging the immersion suit or being injured;
- If the immersion suit is to be worn in conjunction with a lifejacket, the lifejacket shall be worn over the immersion suit. A person wearing such an immersion suit shall be able to don a lifejacket without assistance;
- An immersion suit made of material with inherent insulation, when worn either on its own or with a lifejacket if the immersion suit is to be worn in conjunction with a lifejacket, shall provide the wearer with sufficient thermal insulation, following one jump into the water from a height of 4.5 m, to ensure that the wearer's body core temperature does not fall more than 2'C after a period of 6 h immersion in calm circulating water at a temperature of between 0"C and 2'C.

Fig. 2.7 Immersion suits

* *Anti-exposure suits*

- Is made of material which reduces the risk of heat stress during rescue and evacuation operations;
- Can be unpacked and donned without assistance within 2 minutes;
- Does not sustain burning or continue melting after being totally enveloped in a fire for a period of 2 s;
- Has a lateral field of vision of at least 120˚;
- Provides inherent buoyancy of at least 70 N;

Shall permit the person wearing it to:

- Climb up and down a vertical ladder of at least 5 m in length;
- Swim through the water at least 25 m and board a survival craft;
- Jump from a height of not less than 4.5 m into the water with feet first, without damaging or dislodging the suit, or being injured;
- Perform all duties associated with abandonment, assist others and operate a rescue boat.
- Able to turn from a face-down to a face-up position in not more than 5 seconds and shall be stable face-up. The suit shall have no tendency to turn the wearer face-down in moderate sea conditions.

Fig. 2.8 Anti-exposure suit

* *Thermal protective aids*

- Cover the whole body of persons of all sizes wearing a life jacket with the exception of the face. Hands shall also be covered unless permanently attached gloves are provided;
- Be capable of being unpacked and easily donned without assistance in a survival craft or rescue boat;
- Permit the wearer to remove it in the water in not more than 2 min, if it impairs ability to swim;
- The thermal protective aid shall function properly throughout an air temperature range -30˚C to +20˚C.

Fig. 2.9 Thermal protective aid

2.3.3 Personal preparation for abandoning ship

Being properly prepared is the best way to ensure survival at sea. Since it is somewhat impractical to actually sink a ship for practice, the alternative is training.

Crew members and research personnel should be thoroughly trained in all aspects of survival techniques from the Muster list to launching lifeboats.

You should participate in the weekly emergency drills as if they were the real thing. Report to stations fully clothed, wear shoes, put on your lifejacket, and bring your immersion suit. In an actual emergency, you may not have time to go back to your quarters.

When the command "Prepare to Abandon Ship" is passed, along with the appropriate emergency signal, the crew instantly begins a planned series of actions similar to the following scenario:

- Muster at your assigned station; provide all equipment to the scene as assigned on the Station Bill; come to your station fully clothed with your lifejacket on and carrying your immersion suit.

If there is sufficient time before the actual evolution begins, don your immersion suit first and keep your lifejacket handy. The suit provides flotation and protects you from the elements.

- Prepare all survival craft for immediate launching. Swing out lifeboats or prepare life rafts according to standard procedures. DO NOT LAUNCH any equipment until instructed to do so by the Master. Stand by calmly at your station and await further orders.

- When the Master orders "Abandon Ship," launch all survival craft. Enter boats and rafts using ladders rather than jumping over the side. Keep calm and organized.

- Once boarded, all rafts or boats are tethered and towed away from the ship by a motor lifeboat or the rescue boat. Keep all craft together in the vicinity of the ship's last position.

- While waiting for rescue units to arrive, maintain a continuous visual and radio communication watch. Your lifeboat or life raft is well-stocked with equipment

and provisions to sustain life comfortably. Use the supplies in the survival craft with care-they may have to last a while.

2.3.4 Crew duties to passengers & launching survival craft

- summoning of passengers to muster stations with the alarm required announcement on the public address or other communication system and ensuring that they are made aware of the order to abandon ship;
- reporting to stations and preparing for the duties described in the muster list;
- checking that passengers are suitably dressed;
- checking that lifejackets are correctly donned;
- lowering survival craft after any necessary preparation for launching;
- starting and operating the lifeboat engine;
- a search and rescue of passengers trapped in their staterooms.

Preparation and handling of survival craft at any one launching station shall not interfere with the prompt preparation and handling of any other survival craft or rescue boat at any other station.

During preparation and launching, each survival craft, its launching appliance, and the area of water into which it is to be launched shall be adequately illuminated by lighting supplied from the emergency source of electrical power.

2.3.5 Lowered of survival craft at embarkation deck or sea level and deployed of the marine evacuation system

The order to lowering of survival craft or to deploy the marine evacuation system will be done ONLY by master or his deputy.

2.3.6 Radio equipment and other aids to attract attention

As per muster list duties, the radio equipment as two way VHF radiotelephone apparatus, Search and Rescue Transponder (SART), Emergency Position Indicating Radiobeacon (EPIRB), pyrotechnics, torch, whistle, orange cover or canopy, daylight signalling mirror, must be taken into the survival craft.

3. Abandon ship

NO SHIP IS ABANDONED EXCEPT BY ORDER OF THE MASTER

The order "ABANDON SHIP" will be done ONLY by master or his deputy and ABANDON signal MUST always be confirmed by word from the Master

3.1 Actions to be taken when required to abandon ship

It cannot be overstressed that the order to abandon ship is the final decision to be taken by the Master when, according to his judgment, there is no other way to save the lives the of passengers and the crew.

Hasting to abandon ship is not recommended because in most emergency cases the ship remains the safest place to be on and people have often drowned after abandoning a ship that eventually did not sink.

3.1.1 Additional items which can be carry in the life boat

If it is obvious that the ship is in great danger of sinking, but that there is still a little time in hand before it will become necessary to abandon ship, a coxswain would do well to have some extra gear put in the boat, always remembering that more extra gear put in the boat, the less room will be available for survivors.

A suitable collection of extra gear might be summed up as follows:

- as many blankets as possible
- tinned milk
- milk tablets
- biscuits
- fruits
- torches, batteries and bulbs
- recipients with drinking water and provisions
- extra fuel and lubricants
- medicines and sanitary items
- binoculars and a sextant
- small radio receiver
- the ship's pyrotechnics if unused
- ship's flag and signaling flag
- ship's radio equipment as portable VHF
- individual documents of embarked personnel

3.1.2 Abandon ship – immediate action

- Sound the general emergency signal and make announcements instructing all personnel to proceed to their lifeboat muster stations;
- Initiate vessel shutdown procedures;
- Send a «Mayday» signal with the vessel's position on 2182 KHz and VHF channel 16 (156.8 KHz) and INMARSAT (where applicable);
- Collect, secure ship log books and documents and ensure that there are safely transferred in the boats;
- Ensure that the two on board SART's and EPIRB are carried to the muster stations;
- Carry out a muster of personnel against the lifeboat checklist reporting the names of any missing personnel to the bridge;
- Give the final order to embark all personnel into the lifeboat and to abandon ship;
- Prepare the lifeboat and then lower it to the embarkation position;
- Vacate the bridge and board the lifeboat;
- When ordered by the Master, embark the lifeboat;
- Immediately after the lifeboat is waterborne, and everybody has embarked, move away from the vessel.

3.1.3 Manning of survival craft and supervision

Regulation 10 (1974, SOLAS Convention)

There shall be a sufficient number of trained persons on board for mustering and assisting untrained persons.

There shall be a sufficient number of crew members, who may be deck officers or certificated persons, on board for operating the survival craft and launching arrangements required for abandonment by the total number of persons on board.

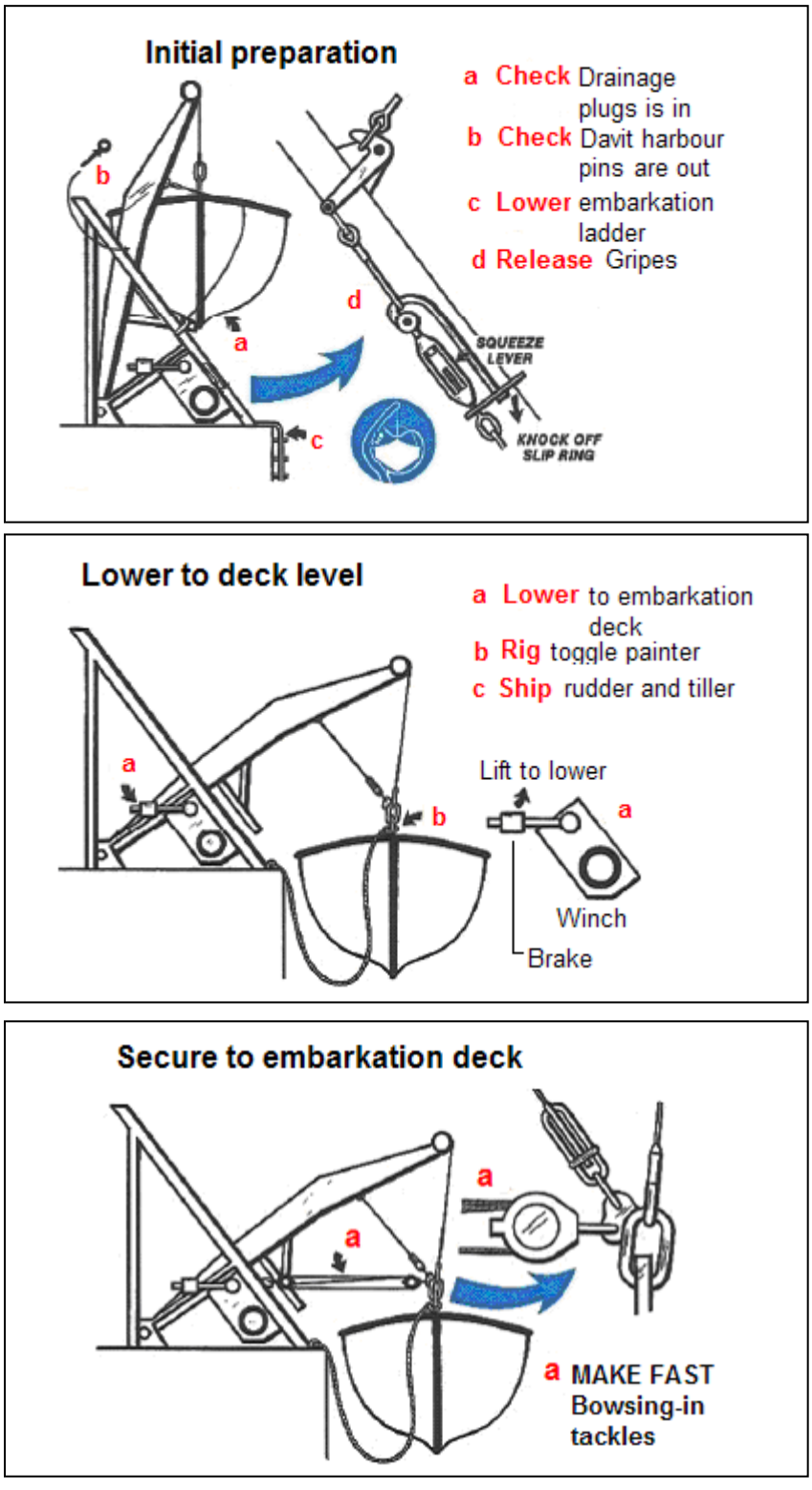
A deck officer or certificated person shall be placed in charge of each survival craft to be used. However, the Administration, having due regard to the nature of the voyage, the number of persons on board and the characteristics of the ship, may permit persons practised in the handling and operation of liferafts to be placed in charge of liferafts in lieu of persons qualified as above.

A second-in-command shall also be nominated in the case of lifeboats.

The person in charge of the survival craft shall have a list of the survival craft crew and shall see that the crew under his command are acquainted with their duties. In lifeboats the second-in-command shall also have a list of the lifeboat crew.

Every motorized survival craft shall have a person assigned who is capable of operating the engine and carrying out minor adjustments.

3.1.4 Launching procedure of open lifeboat



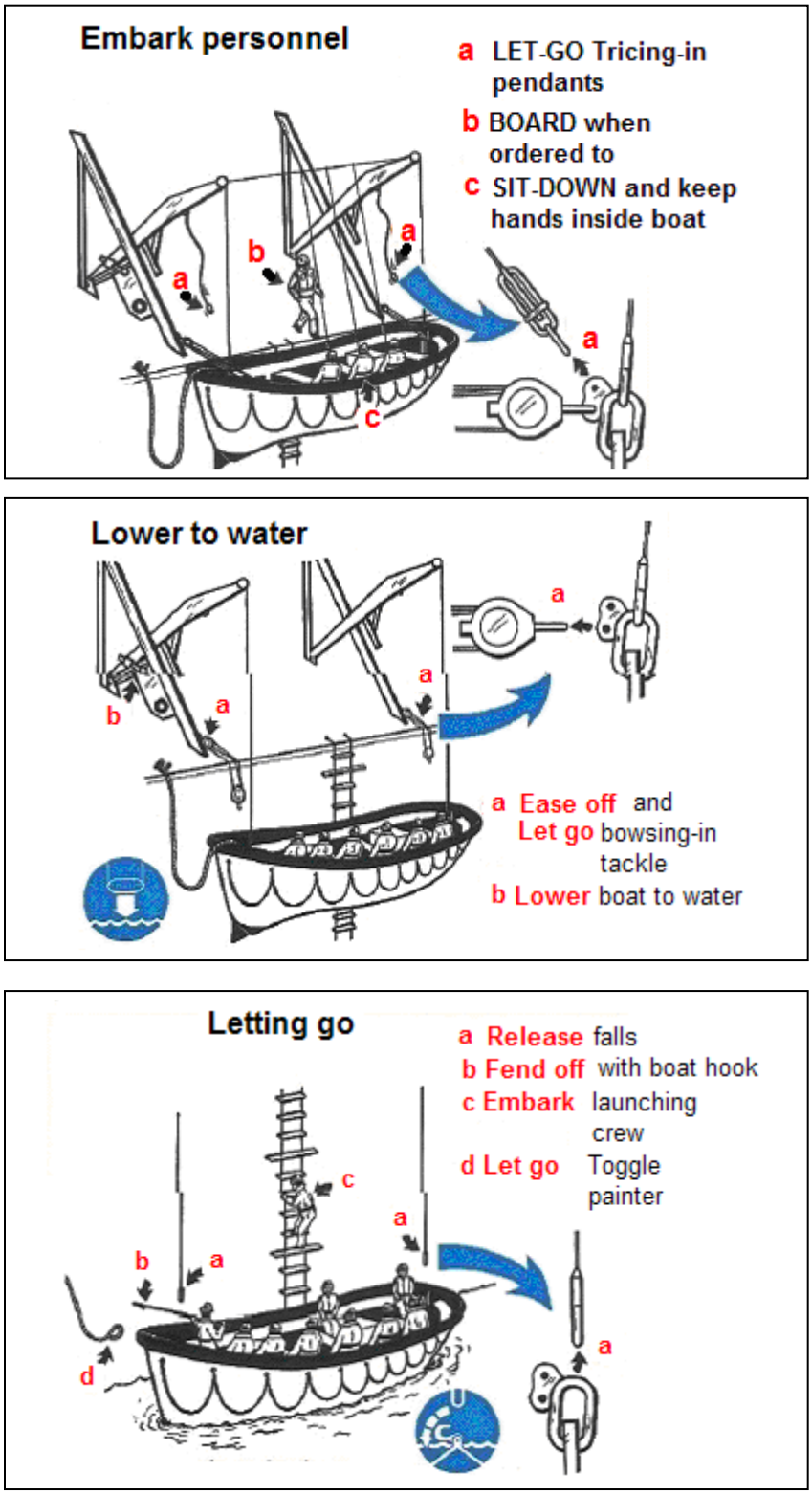
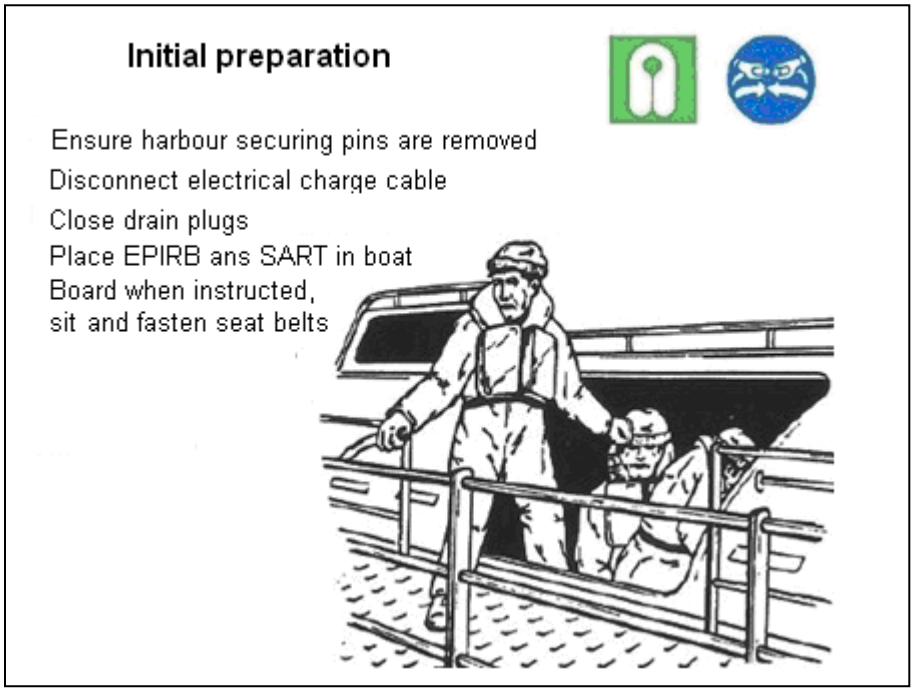
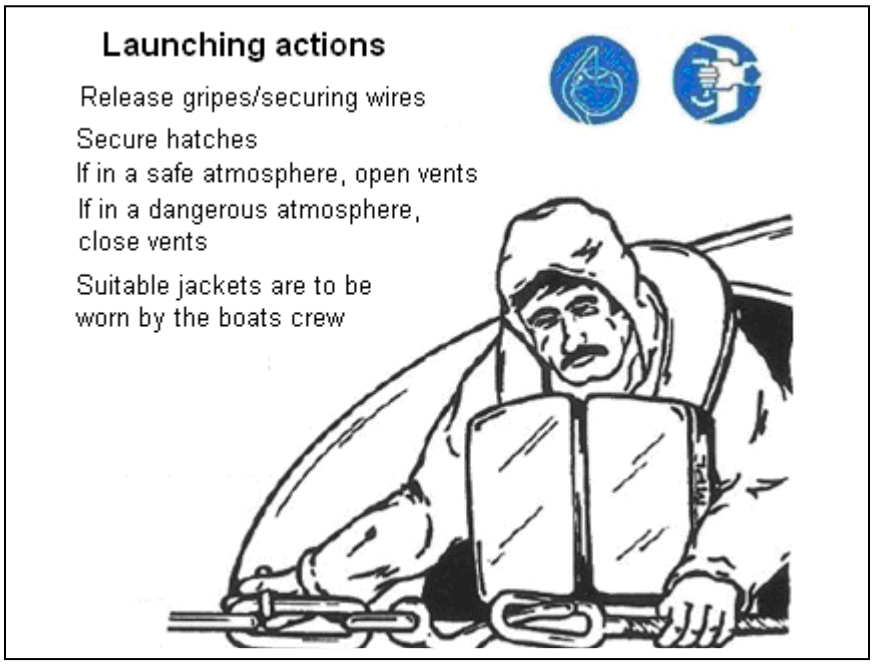
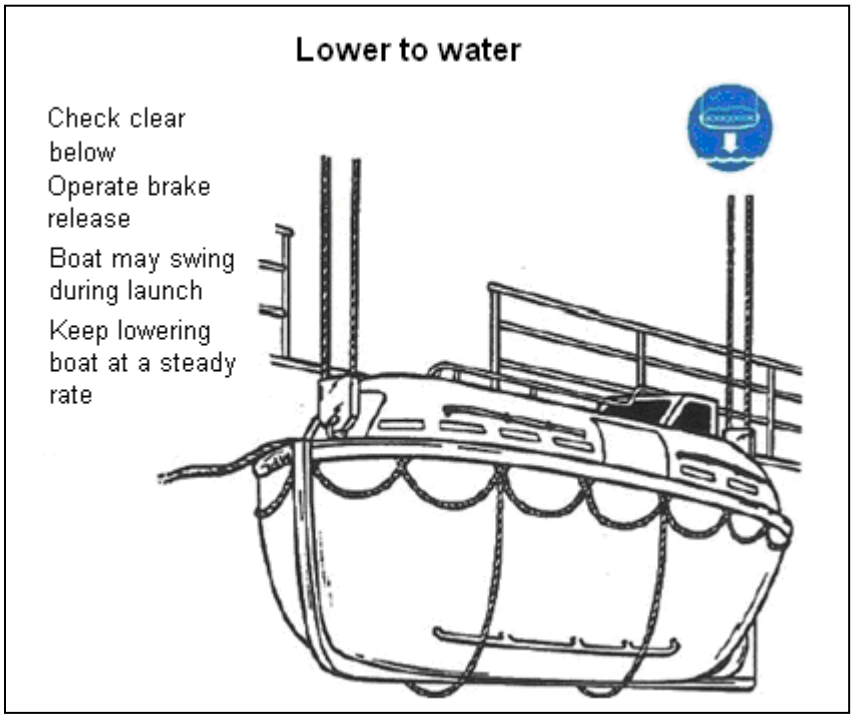

Embark personnel
a LET-GO Tricing-in pendants
b BOARD when ordered to
c SIT-DOWN and keep hands inside boat
Lower to water
a Ease off and Let go bowsing-in tackle
b Lower boat to water
Letting go
a Release falls
b Fend off with boat hook
c Embark launching crew
d Let go Toggle painter

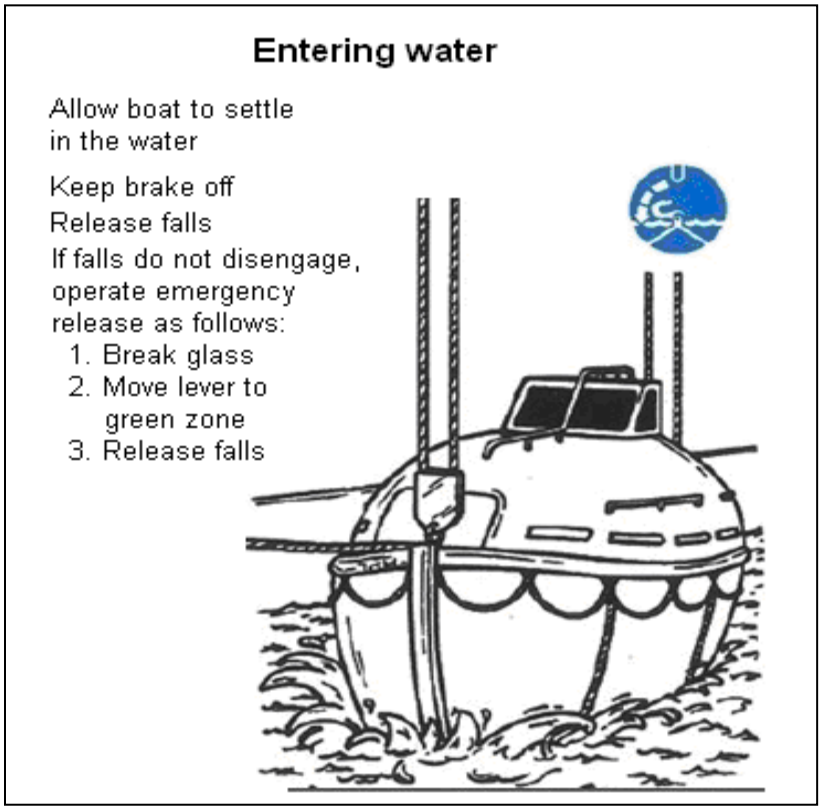
Fig. 3.1 Launching steps of open life boat

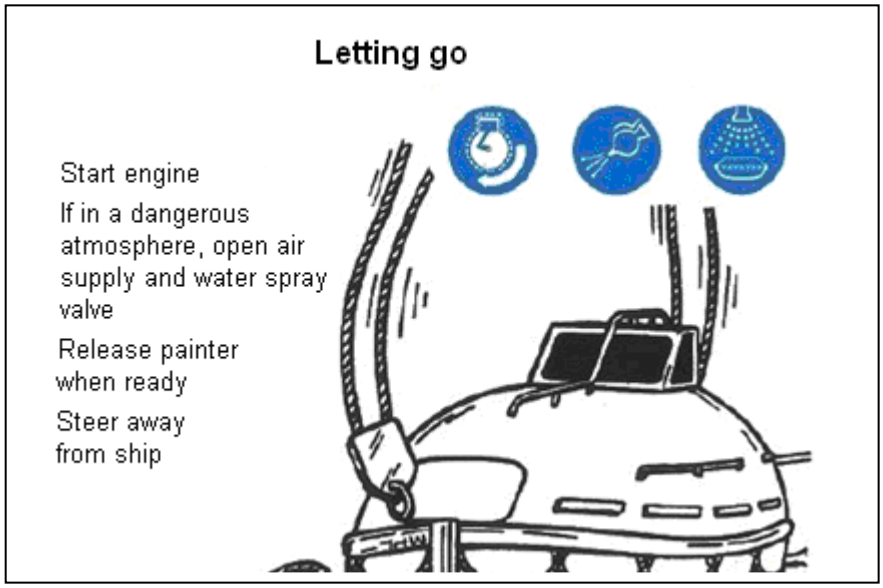
3.1.5 Launching procedure of enclosed lifeboat


Initial preparation
Ensure harbour securing pins are removed
Disconnect electrical charge cable
Close drain plugs
Place EPIRB ans SART in boat
Board when instructed,
sit and fasten seat belts




Lower to water
Check clear below
Operate brake release
Boat may swing during launch
Keep lowering boat at a steady rate


Entering water
Allow boat to settle in the water
Keep brake off
Release falls
If falls do not disengage, operate emergency release as follows:
1. Break glass
2. Move lever to green zone
3. Release falls


Letting go
Start engine
If in a dangerous atmosphere, open air supply and water spray valve
Release painter when ready
Steer away from ship

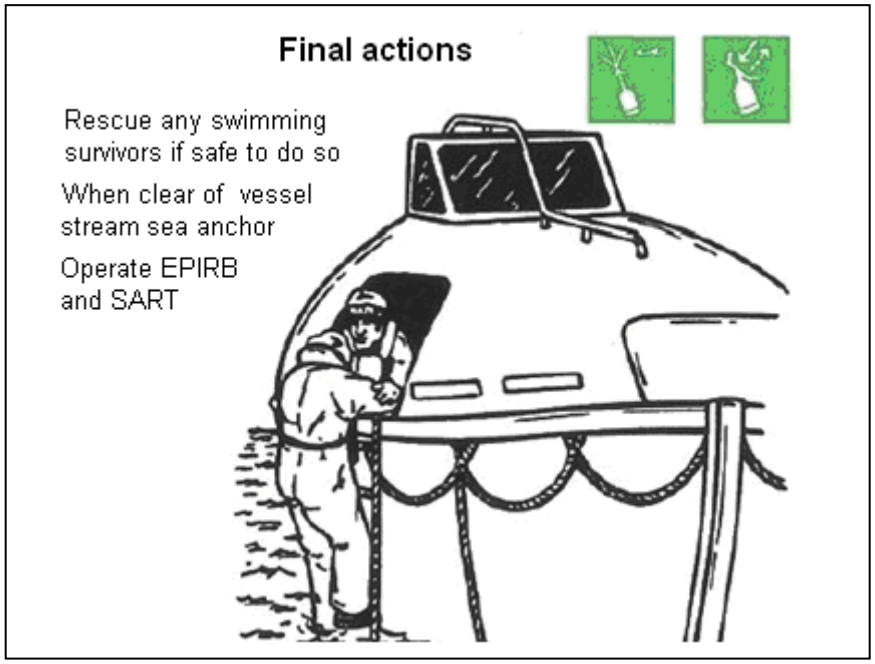

Final actions
Rescue any swimming survivors if safe to do so
When clear of vessel stream sea anchor
Operate EPIRB and SART

Fig.3.2 Launching steps of enclosed lifeboat

3.1.6 Launching procedure of the inflatable liferaft

The web straps securing the raft in its stowage cradle should be released by slipping the manually operated senhouse slip positioned above the float-free arrangement. The liferaft container should then be manhandled to the launching position at the ship's side. If ship's guard are in position, these should be removed to facilitate an easier launching.

The painter line from the liferaft should be secured to a strong point aboard the vessel. Where a hydrostatic release unit is featured, the painter and the " D" ring should be inspected to ensure that they are well fast.

Pull out a limited amount of the painter line from the container, and check that water surface is clear of other survivors or debrits. Throw the liferaft in its container, over the side into clear water. Inflation will be caused by a sharp "tug" on the painter once it is fully extended. The action of pulling sharply on the painter line will cause the CO_2 gas bottle to be fired, so inflating the liferaft.

Abandon ship by means of a throw overboard inflatable liferaft

- Check that the painter is well secured to a strong point;
- Check that all is clear overside. Let go lashing and take the raft to the ship's side, remove a portable rail if necessary;
- Launch the liferaft overboard in its container;
- Pull the remainder of the painter out of the floating container and tug it hard to fire the gas bottle;
- The liferaft will take 20 to 30 seconds to inflate;
- Board the liferaft from a side ladder, a rope or from sea;
- Jettison all shoes and sharp objects (rings, diamond, brooches, etc.)
- When everyone is aboard, cut the painter with the safety knife;
- In cold weather inflate the double floor;
- Ventilate the raft well before closing entrances. Stream the sea-anchor;
- Endeavour to remain in the vicinity with the other rafts and boats.

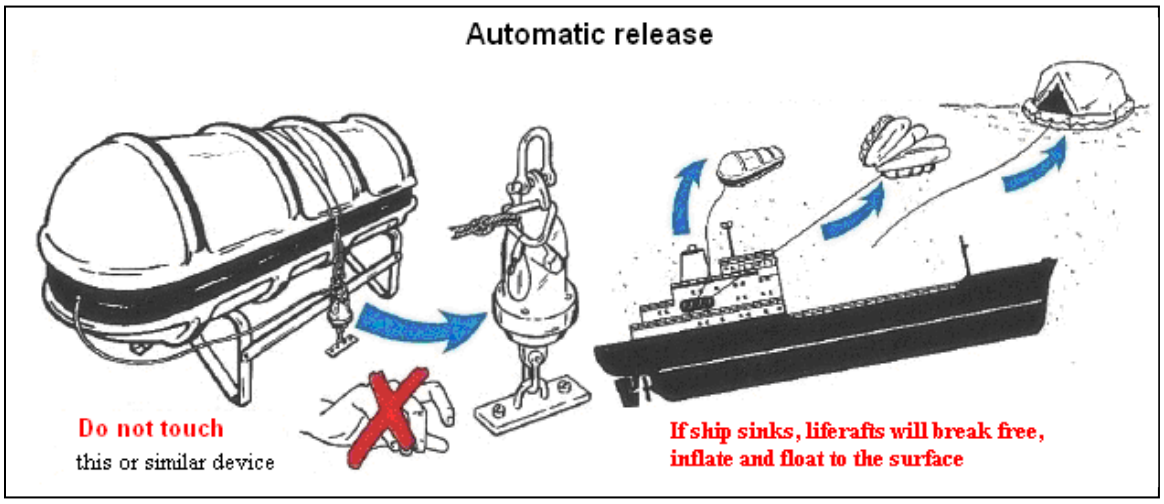
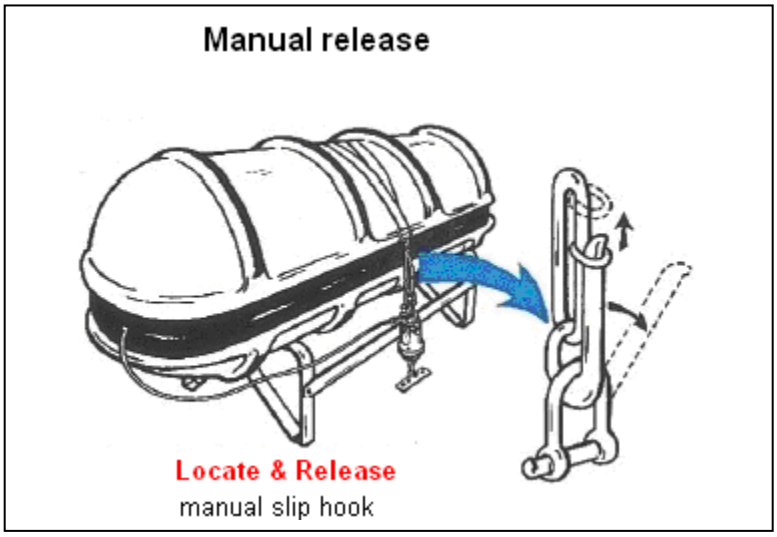
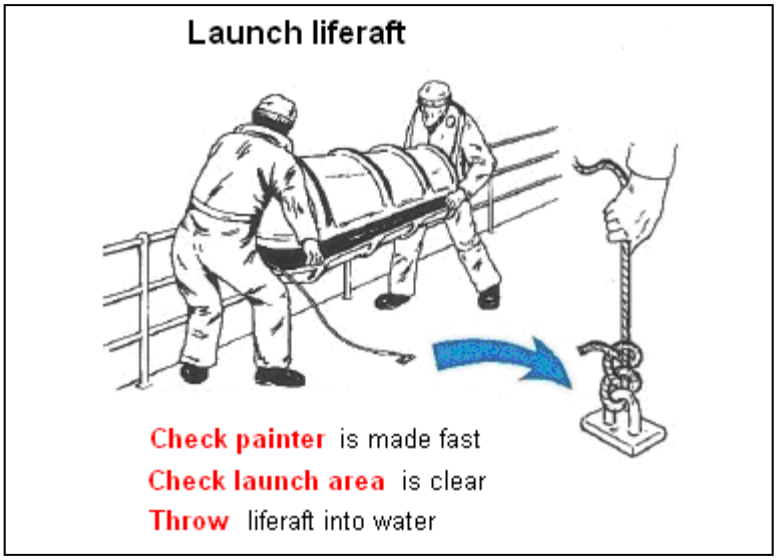

Automatic release
Do not touch
this or similar device
If ship sinks, liferafts will break free,
inflate and float to the surface

Fig.3.3 Steps of automatic release of liferaft





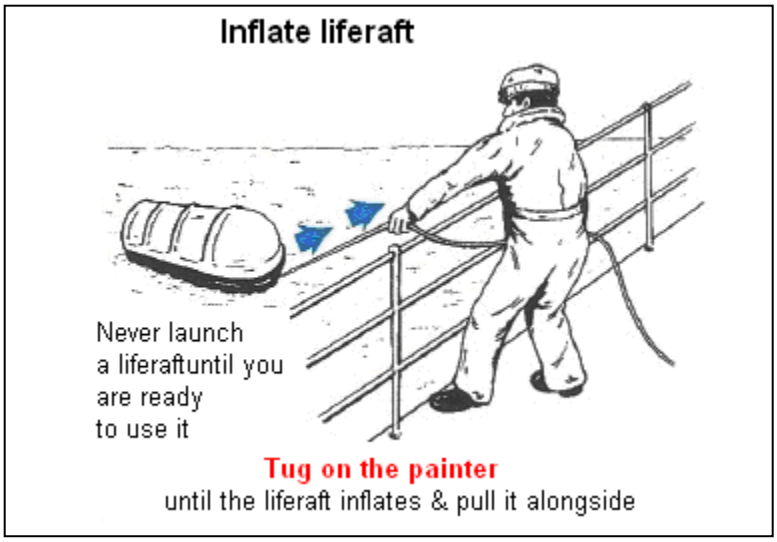


Fig.3.4 Steps of manual release of liferaft

Boarding of liferaft

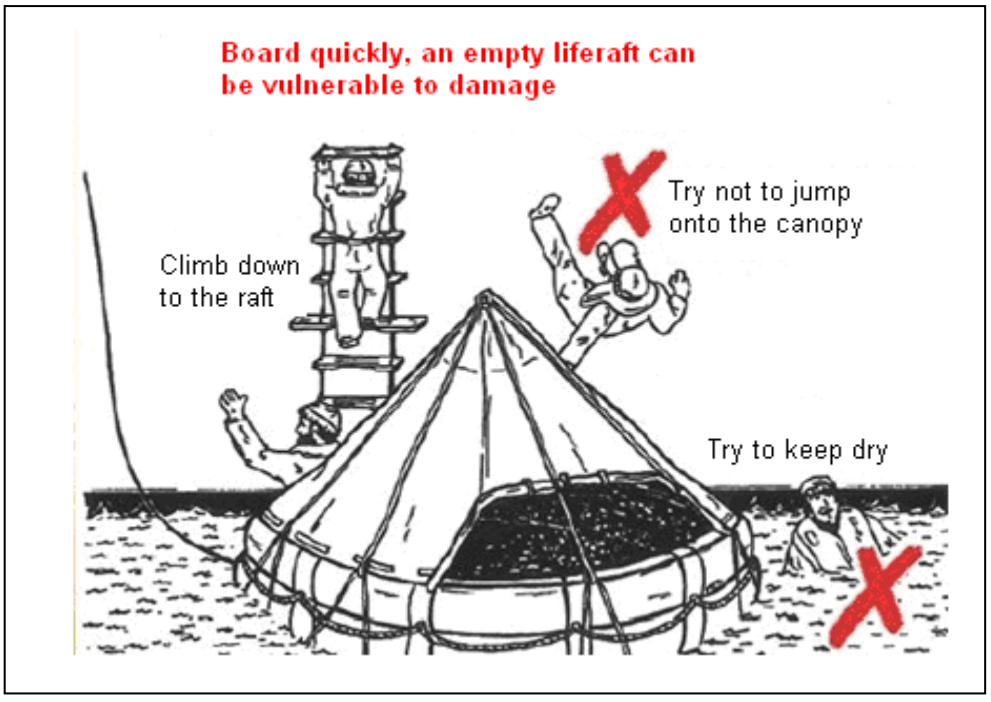


Fig. 3.5 Boarding of liferaft

Embarkation into inflatable liferafts:

- Climb down the ship or installation side to the vicinity of the liferaft.
- Step directly into the entrance of the raft if you are within about 2 meters range.

- Do not attempt to jump into the liferaft from any greater height than this or you will probably injure yourself on the buoyancy ring chambers of the liferaft.
- Failing this, you could cause damage to the floor or canopy of the raft with the fabric tearing away from the buoyancy support.
- Once inside the liferaft, clear away from entrances and carry out full survival procedures.
- You don't want to be wet and freezing if you can just as easily be dry and freezing. If there is no means of climbing down and you must jump, *do not jump into the raft*.
- Do not jump into the water unless it is essential;
- Use an overside ledder or, if unavoidable, never jump from higher than 6meters (20 feet) into the water.
- If it is necessary to enter the water, choose a suitable place from which to leave the ship.

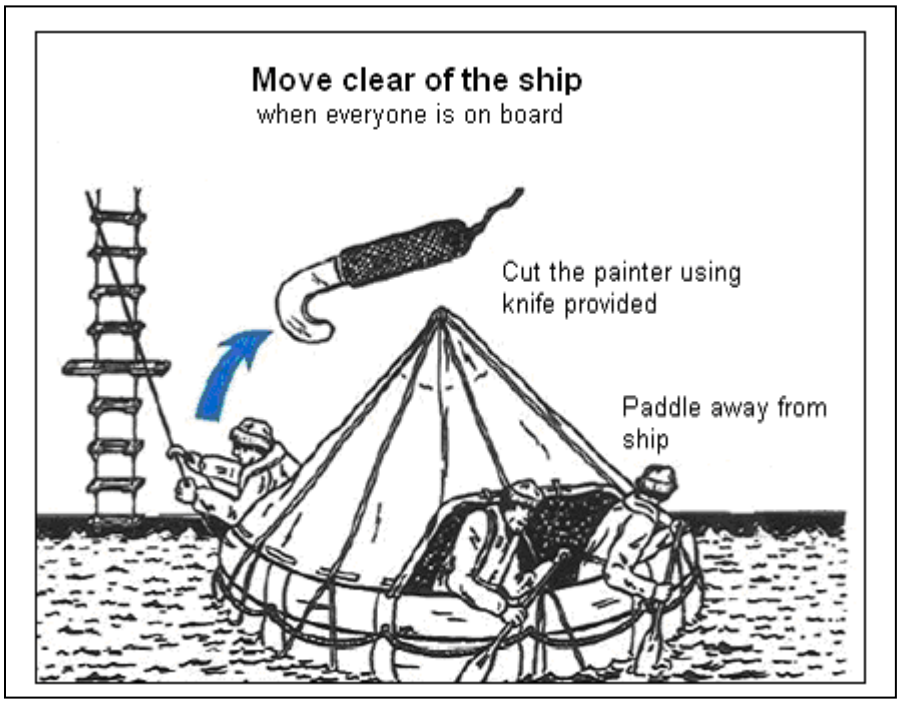


Fig. 3.6 Clear the ship

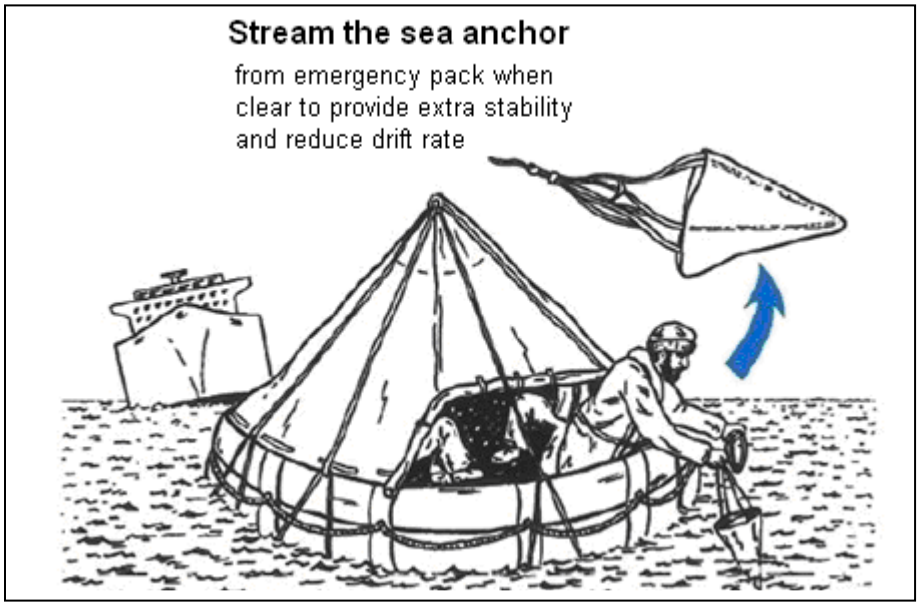


Fig. 3.7 Use of sea anchor

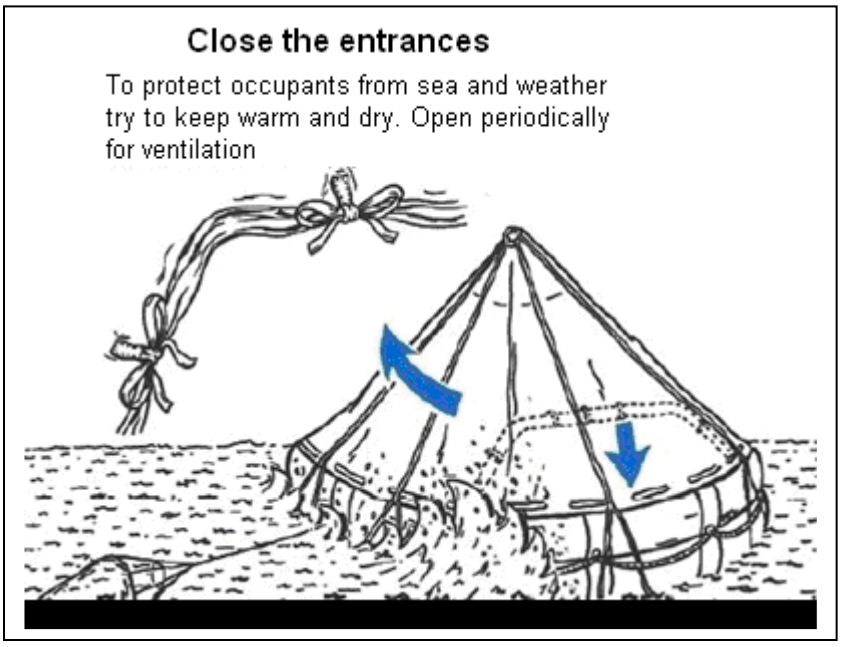

Close the entrances
To protect occupants from sea and weather
try to keep warm and dry. Open periodically
for ventilation

Fig. 3.8 Closing the entrance

3.1.7 Points to bear in mind before jumping overboard

a) Have your life jacket securely tied on and hold it down by crossing the arms over the chest; blocking off the nose and mouth with one hand.

b) Keep your feet together, check that it is all clear below; look straight ahead; jump feet first.

c) Do not look down when jumping as it makes you unstable and likely to fall forward.

d) Wearing a lifejacket and possibly an immersion suit or thermal protective aid and certainly wearing heavy clothing. It may be easier when swimming to a survival craft, to swim on your back. Do not swim or tread water unnecessarily; It wastes valuable body heat and energy.

Stay out of the water as long as possible! Try to minimize the shock of sudden cold immersion. A sudden plunge into cold water can cause rapid death, or an uncontrollable rise in breathing rate may result in an intake of water into the lungs.

If jumping into the water is unavoidable, you should try to keep your elbows to your side and cover your nose and mouth with one hand while holding the wrist or elbow firmly with the other hand. Avoid jumping onto the liferaft canopy or jumping into the water astern of a liferaft, in case the ship has some remaining headway

Jumping into the raft will likely break either one or both of your legs, or break the legs or other vital body parts of those already in the raft. If you have to jump, aim for the water - better to be wet and freezing than unable to swim or walk.

3.1.8 Importance to keep dry when boarding survival craft

In a survival craft wearing clothes that are wet with salt water, you will be much more prone to the debilitating effects of salt water boils and bed sores, all of which will quickly turn into open wounds.

Woollen clothing next to the skin will aggravate the condition. While wool is probably the best type of warm clothing you can wear.

A long sleeved cotton shirt and cotton underpants next to the skin will reduce the aggravation.

Do not urinate in your clothes, it will quickly cause a most painful nappy rash.

Provided you have been castaway in a temperate zone and encounter a heavy rainstorm and you are not suffering badly from hypothermia.

Undress, wash the salt and sweat from your body and the salt out of your clothing.

Having wrung out your clothing, put it on again.

Clean wet clothes and a clean body will be far more comfortable than dry salt laden clothes and body heat will dry your clothes.

Unfortunately, sitting for long periods in a survival craft is bound to cause the formation of bed sores on the back, buttocks and heels, the presence of salt in your clothes adds to the inflammation and increases the resulting pain.

If your clothing is wet, remove it, wring it out as dry as possible and put it back on.

In general, clothing should be shared among survivors, but take special care of the sick and injured. Waterproof or windproof clothing should be made available to those on lookout duty in the open.

3.1.9 Life boat in-board engine

- Every lifeboat shall be powered by a compression ignition engine. No engine shall be used for any lifeboat if its fuel has a flashpoint of 43˚C (109˚F) or less (closed cup test).
- The engine shall be provided with either a manual starting system or a power starting system with two independent rechargeable energy sources.
- The engine starting system and starting aids shall start the engine at an ambient temperature of -15˚C (+5˚F) within 2 minutes of commencing the start procedure.
- The engine shall be capable of operating for not less than 5 minutes after starting from cold with the life boat out of the water.
- The engine shall be capable of operating when the lifeboat is flooded up to the centreline of the crankshaft.
- The lifeboat engine, transmission and engine accessories shall be enclosed in a fire-retarding casing or other suitable arrangements providing similar protection.
- The lifeboat engine and accessories shall be designed to limit electro-magnetic emissions so that engine operation does not interfere with the operation of radio equipment used in the lifeboat.
- Water resistant instructions for starting and operating the engine shall be provided and mounted in a conspicuous place near the engine starting controls.
- The exhaust pipe shall be arranged as to prevent water from entering the engine in normal operation.
- The engine are to be test run once a week.
- The speed of a life boat when proceeding ahead in calm water when loaded with its full complement of persons and equipment, shall be at least 6 knots and at least 2 knots when towing a 25 person liferaft loaded with its full complement of persons and equipment.
- Sufficient fuel shall be provided to run the fully loaded lifeboat at 6 knots for a period of not less than 24 hours.

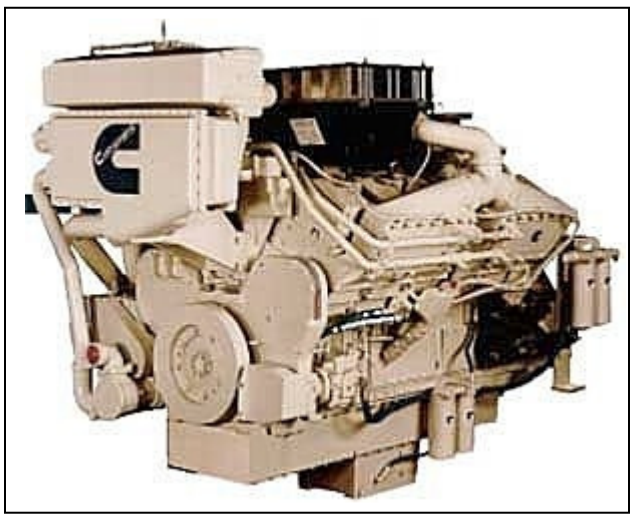


Fig.3.9 Lifeboat in-board engine

3.1.9 Lifeboat out-board engine

- Where an outboard motor has been fitted, the boat must be equipped with a dry powder fire extinguisher suitable for oil fires and a set of tools and spares.
- The motor shall be permanently attached to the boats they are intended to propel.
- Portable engine will have securing lines in the bow of the boat for securing the fuel tank. There shall be a means of ensuring that fuel cannot escape when fuel pipes are disconnected.
- Outboard motor must never de laid horizontally and if unshipped, must be stowed upright in a rack. Cases have occurred when outboard motors have been laid horizontally, of sea water getting into the engine and causing corrosion which has put the engine completely out of service.
- Out board engine are to be test run once a week.

Fig.3.10 Lifeboat out- board engines

3.2 Actions to

be taken when in the water

If go into the water, *never go in without a lifejacket*, and an immersion suit or thermal aid.

However, warm clothing will trap air and air provides warmth.

You cannot swim far in heavy clothing, neither can you swim far in a lifejacket.

Do not try to swim unnecessarily, it uses vital energy and assists hypothermia to set in.

Try and take something buoyant with you into the water to assist you to keep afloat.

If you are only scantily clothed, you will certainly die of exposure either in or out of the water.

Wet clothing is far better than no clothing.

In cold weather is a survival craft, remove and wring out the top layer of wet clothing and put it on again as quickly as possible.

If you have to go into the water from a survival craft, perhaps to help rescue another survivor.

Be sure to take a line with you. A survival craft will drift far faster than you can swim, without a line to help you to get back to the survival craft, you may well find yourself unable to get back to safety.

Survivors in the water should hang onto lifeboats, liferafts, and buoyant apparatus by putting their arms through the loops of the lifelines, rather than hold onto them, for the hands get numb and let go.

- Avoid staying in the water for one second longer than you need to.

Body heat will be lost to the surrounding water more rapidly than it can be generated. This leads to hypothermia (cold exposure), unconsciousness and death.

- Wearing extra clothing will help delay the start of hypothermia.

Get into the liferaft as soon as possible.

- When you are in the water, whether or not you are in a liferaft, try to stay near the boat. It may not sink and you may be able to re-board. If it stays afloat, searches will be able to spot it more easily than they can spot you. Staying close to the boat also keeps you closest to the position reported in your distress call.
- If you cannot get into a liferaft, do not swim aimlessly; swimming increases heat loss. Remain as still as possible using flotation to keep you high in the water. Heat loss occurs much faster in water than in air, so the more of your body you can keep out of the water the better.
- Now is the time to inflate the external bladder on your exposure suit by means of the mouth tube. You may be able to get on top of floating debris (a lifebuoy, a board, even a dead body) to help keep you out of the water.
- If you don't have an exposure suit, use the H.E.L.P. (heat escape lessening posture) technique. If your exposure suit of PFD has a whistle attached, use it to attract attention.

- You may not be visible, but using the whistle will enable you to let others know where you are. If you have taken the time to prepare a personal survival kit, you may have other signaling devices that will boost your chances of rescue. Use them wisely.
- If possible, form a group with other survivors in the water. There is safety in numbers, and a group is more easily located and more likely to maintain morale. Huddling together will also decrease heat loss.

4. Survival craft and rescue boats

4.1 Lifeboats

LSA Code, Chapter IV

4.1.1 General requirements for lifeboats

a) *Materials*

The materials from which the lifeboat hull, deck, and canopy are constructed shall be resistant to deterioration from:

- air temperature in the range of -30 to +65°C.;
- rot, corrosion, seawater, oil and fungus; and,
- sunlight.

Lifeboats shall be constructed of steel, aluminum or fibrous glass reinforced plastics, except other materials if such are equivalent or superior to the specified materials in physical properties and durability in a marine environment.

b) *Design and Construction*

All lifeboats shall

- be properly constructed;
- have rigid hulls;
- be of such form and proportions that they have ample stability in a seaway and sufficient freeboard when loaded with their full complement of persons and equipment;
- be capable of maintaining positive stability when in an upright position in calm water and loaded with their complement and equipment and holed in any one location below the waterline, assuming no loss of buoyancy material or other damage.

Every lifeboat shall be capable of being launched and its equipment capable of being operated by persons wearing immersion suits.

All lifeboats shall be of sufficient strength to:

- enable them to be safely lowered into the water when loaded with their complement and equipment;
- be capable of being launched and towed when the ship is making headway at a speed of 5 knots in calm water.

Hulls and rigid canopies shall be fire retardate or noncombustible.

Seating shall be provided on thwarts, benches or fixed chairs fitted as low as practicable in the lifeboat capable of supporting the number of persons each weighing 100 kg. for which spaces are provided.

Each lifeboat shall be of sufficient strength to withstand a load, without residual deflection on removal of that load:

- in the case of boats with metal hulls, 1.25 times the total mass of the lifeboat when loaded with its full complement of persons and equipment; or
- in the case of other boats, twice the total mass of the lifeboat when loaded with its full complement of persons and equipment.

Each lifeboat shall be of sufficient strength to withstand, when loaded with its full complement of persons and equipment and with, where applicable, skates or fenders in position, a lateral impact against the ship's side at an impact velocity of at least 3.5 m/s and also a drop into the water from a height of at least 3m.

The vertical distance between the floor surface and the interior of the canopy or enclosure over at least 50 % of the floor area shall be

- not less than 1.3 m for a lifeboat permitted to accommodate 9 persons or less;
- not less than 1.7 m for a lifeboat permitted to accommodate 24 persons or more;
- not less than the distance as determined by linear interpolation between 1.3 m & 1.7 m for a lifeboat permitted to accommodate between 10 and 23 persons.

c) *Carrying capacity*

The number of persons which a lifeboat shall be permitted to accommodate shall be equal to:

- the number of persons, all wearing immersion suits, that can be seated in a normal position with out interfering with the means of propulsion or the operation of any of the lifeboat's equipment; or,
- the number of spaces that can be provided on the seating arrangements. The shapes may be overlapped as shown, provided that footrests are fitted and there is sufficient room for legs and the vertical separation between the upper and lower seats is not less than 350 mm.

Each seating position within a lifeboat shall be clearly indicated.

d) *Access*

Every passenger ship lifeboat shall be so arranged that:

- it can be rapidly boarded by its full complement of persons; and,
- rapid disembarkation can be possible.

Every cargo ship lifeboat shall be so arranged that:

- it can be boarded by its full complement of persons in not more than 3 minutes from the time that the instruction to board is given; and,
- rapid disembarkation can be possible.

Surfaces on the lifeboat on which persons might walk shall have a non-slip finish.

Every lifeboat shall have a boarding ladder so arranged that:

- it can be used on either side to enable persons in the water to board;

and

- the lowest step shall not be less than 0. 4 m below the light waterline.

Every lifeboat shall be so arranged that helpless persons can be brought on board both from the water and on stretchers.

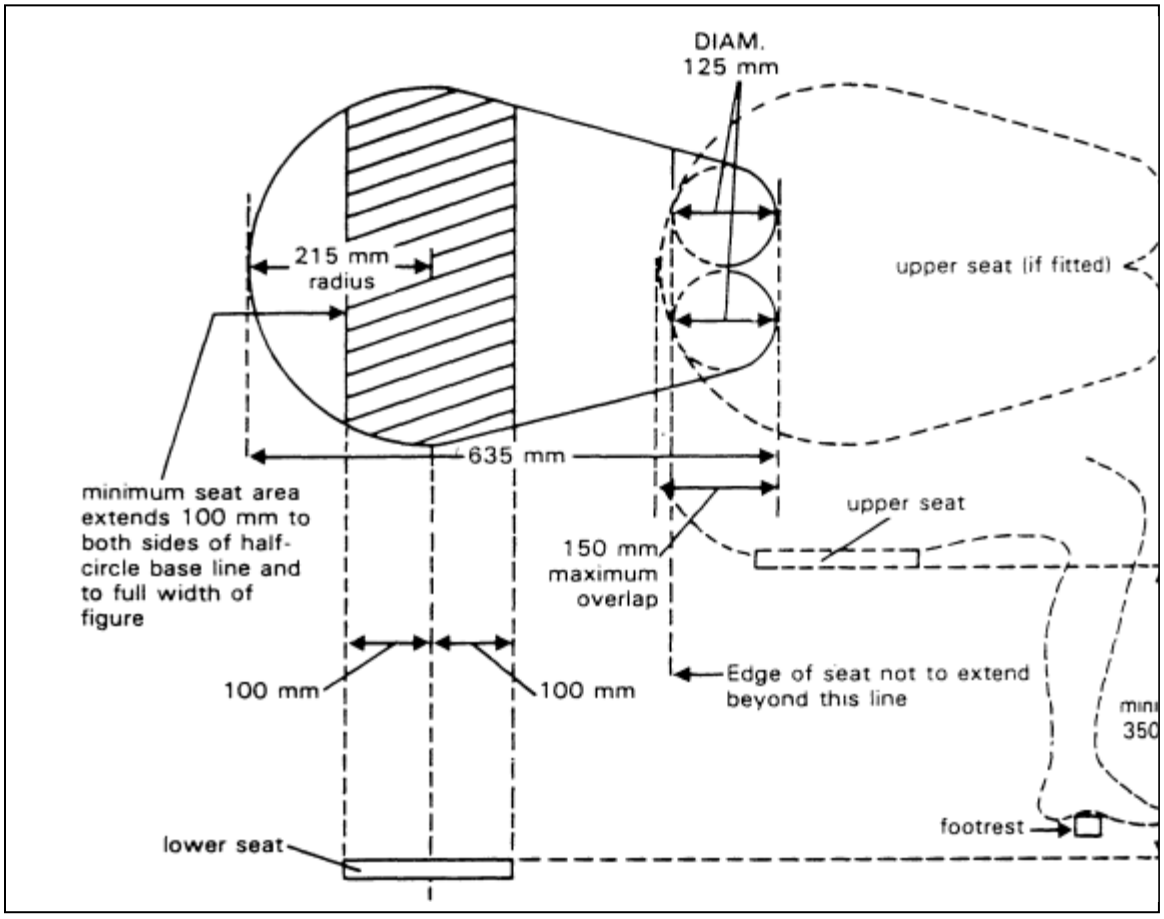


Fig. 4.1 The seating arrangements

e) *Buoyancy*

All lifeboats shall have inherent buoyancy or shall be fitted with inherently buoyant material sufficient to float the lifeboat with all its equipment on board when flooded and open to the sea.

The buoyant material used in a lifeboat shall not be adversely affected by sea water, oil or oil products. Notwithstanding the up mentioned requirements, all lifeboats shall have additional inherently buoyant material equal to 280 N of buoyant force per person for the number of persons the lifeboat is permitted to accommodate.

Buoyant material, shall not be installed external to the hull of the lifeboat.

f) *Freeboard and Stability*

All lifeboats shall be stable and have a positive GM value when loaded with 50% of the number of persons the lifeboat is permitted to accommodate in their normal positions to one side of the centre line.

All lifeboats, when loaded with 50% of the number of persons the lifeboat is permitted to accommodate seated in their normal positions to one side of the centre line, shall have a freeboard, measured from the waterline to the lowest opening through which the lifeboat may become flooded, of at least 1.5% of the lifeboat's length or 100 mm, whichever is greater.

g) *Fittings*

Every lifeboat shall be provided with at least one drain valve fitted near the lowest point in the hull, which shall

- open automatically to drain water from the hull when not waterborne;
- close automatically to prevent entry of water when waterborne;

Each drain shall be:

- provided with cap or plug to close the valve which shall be securely attached to the lifeboat by a lanyard, chain, or other suitable means;
- readily accessible from inside; and,
- clearly indicated as to its position.

Every lifeboat shall be provided with a rudder and tiller.

When a wheel or other remote steering mechanism is also provided, the tiller shall be capable of controlling the rudder in case of failure of the steering mechanism.

The rudder shall be permanently attached to the lifeboat and the tiller shall be permanently installed on, or linked to, the rudder stock; however, if the lifeboat has a remote steering mechanism, the tiller may be removable and securely stowed near the rudder stock.

The rudder and tiller shall be arranged so as not to be damaged by the operation of the lifeboat release mechanism or the propeller.

A buoyant lifeline shall be around the outside of the lifeboat, except in the vicinity of the rudder and propeller.

Lifeboats which are not self-righting when capsized, shall have suitable handholds on the underside of the hull to enable persons to cling to the lifeboat. The handholds shall be fastened to the lifeboat in such a way that, when subjected to an impact sufficient to cause them to break away, they break away without causing damage to the lifeboat.

Every lifeboat shall be fitted with sufficient watertight lockers or compartments to provide for the storage of the small items of equipment, water and provisions.

Means shall be provided for the collection and storage of rainwater.

Every lifeboat to be launched by a fall or falls shall be fitted with a release mechanism complying with the following requirements:

- the mechanism shall be so arranged that all hooks are released simultaneously;
- the mechanism shall have two release capabilities as follows
  - a manual release which will release the lifeboat when waterborne or when there is no load on the hooks;
  - an "on-load" release capability which will release the lifeboat with a load on the hooks and be so arranged as to release the lifeboat under any conditions of loading from no-load with the lifeboat waterborne to a load of 1.1 times the loaded mass of the lifeboat when loaded with its complement of persons and equipment.
- the release control shall be clearly marked in a color that contrasts with its surroundings;
- the release mechanism shall be designed with a safety factor of 6 based on the ultimate strength of the materials used, assuming the mass of the lifeboat is equally distributed between the falls.

Every lifeboat shall be fitted with a means to enable the forward painter to be released when under tension.

Every lifeboat shall be provided with a permanently installed earth connection and arrangements for adequately sitting and securing in the operating position the antenna provided with the portable radio apparatus.

Lifeboats intended for launching down the side of a ship shall have skates or fenders as necessary to facilitate launching and prevent damage.

A manually controlled lamp visible on a dark night with a clear atmosphere at a distance of at least 2 miles for a period of not less than 12 hours shall be fitted to the top of the cover of closure. If the light is designed to flash it shall initially flash at a rate of not less than 50 flashes per minute over the first 2 hours of operation of the 12 hour operating period.

Every lifeboat shall have fitted on the inside a lamp or source of light to provide illumination for not less than 12 hours to enable reading of survival and equipment instructions; however, oil lamps shall not be permitted for this purpose.

Every lifeboat shall, unless expressly provided otherwise, be provided with effective means of bailing or be automatically self-bailing.

Every lifeboat shall be constructed and fitted so that an adequate view, forward, aft, and to both sides is provided from the control and steering position for safe launching and maneuvering.

h) *Equipment*

All items of the lifeboat equipment, whether required by this section or elsewhere in this standard, with the exception of boat-hooks which shall be kept free for fending off purposes, shall be secured within the lifeboat by lashings, stored in lockers or compartments, stored in brackets or other similar mounting arrangements or other suitable means.

The equipment shall be secured in such a manner as not to interfere with any abandonment procedure.

All items of the lifeboat equipment shall be as small and of as little mass as possible and shall be packed in a suitable and compact form.

The normal equipment, unless otherwise stated, shall consist of:

- sufficient oars to make headway in calm seas, hole pins, crutches or equivalent arrangements attached to the boat by lanyards or chains shall be provided for each oar,
- two boat hooks,
- a buoyant bailer and two buckets,
- a survival manual,
- a binnacle containing an efficient compass which is luminous or provided with a suitable means of illumination. In a totally enclosed lifeboat, the binnacle shall be permanently fitted at the steering position; in any other lifeboat, it shall be provided with suitable mounting arrangements,
- a sea anchor of adequate size fitted with a shock resistant hawser and tripping line which provides a firm hand grip when wet. The strength of the sea anchor, hawser and tripping line shall be adequate for all sea conditions,
- two painters, manila or other suitable line, having a diameter of not less than 255 mm diameter and of a length equal to not less than twice the distance from the stowage position of the lifeboat to the waterline in the lightest seagoing condition, or, 15 m, whichever is greater. One painter shall be attached to the release device at the forward end of the boat, and the other painter shall be firmly secured at or near the bow of the boat ready for use,
- two hatchets, one at each end of the boat,

- rustproof, watertight container or individually sealed units containing a total of 3 liters of fresh water for each person the lifeboat is permitted to accommodate, of which 1 liter per person may be replaced by an approved desalting apparatus capable of producing an equal amount of fresh water in 2 days,

- a rustproof dipper with lanyard, for the purpose of drawing water from the bunghole of a fresh water container, but this item may be waived in cases where the construction of the containers renders it unnecessary,

- a rustproof graduated drinking vessel, marked at 30, 45 and 60 ml levels,

- an approved food ration totaling not less than 10,000 kJ for each person the lifeboat is permitted to accommodate in airtight packaging and stowed in a watertight container,

- 4 rocket parachute flares,

- 6 hand flares,

- 2 buoyant smoke signals,

- one waterproof electric torch suitable for Morse signaling together with one spare set of batteries and one spare bulb, in a waterproof container,

- one daylight signaling mirror with instructions for its use in signaling to ships and aircraft,

- one copy of lifesaving signals on a waterproof card or in a waterproof container,

- one whistle or equivalent sound signal,

- a first aid kit,

- 6 doses of anti-seasickness medicine and one sea-sickness bag for each person,

- a buoyant safety knife,

- 3 safety openers suitable for opening water and rations supplies,

- two buoyant rescue quoits attached to buoyant lines each not less than 30 m long,

- a manual pump,

- one set of fishing tackle,

- sufficient tools to undertake minor adjustments to the engine and its accessories,

- portable fire extinguishing equipment suitable for extinguishing oil fires,

- a searchlight capable of effectively illuminating a light colored object at night having a width of 18m, at a distance of 180m for a total period of 6 hours and of working for not less than 3 hours continuously,

- an efficient radar reflector or radar transponder.

i) *Markings on lifeboats*

The lifeboat shall be marked in clear permanent letters showing the dimensions, persons which it is permitted to accommodate, approval number, and serial number.

The name and port of registry of the ship to which the lifeboat belongs shall be marked on each side of the lifeboat's bow in block capitals of the Roman alphabet, of not less than 100 mm in height.

Means of identifying the ship to which the lifeboat belongs and the number of the lifeboat shall be marked in such a way that they are visible from above.

Every lifeboat shall have affixed to it retro-reflective tape that complies for the type prescribed therein with the highest level of reflectivity.

4.1.2 Open lifeboat

Open lifeboat shall comply with all requirements up mentioned at 4.1.1

Fig.4.2 Open lifeboat

4.1.3 Partially enclosed lifeboat

Partially enclosed lifeboats shall comply with the requirements of open type and in addition shall comply with the following requirements:

Every partially enclosed lifeboat shall be:

- provided with permanently attached rigid covers extending over not less than 20% of the length from the stem and not less than 20% of the length from the aftermost part of the lifeboat; and,
- fitted with a permanently attached foldable canopy witch together with the rigid covers completely encloses the occupants of the lifeboat in a

weatherproof shelter and provides protection from exposure.

The canopy required under shall be so arranged:

- that it is provided with adequate rigid sections or battens to permit erection;
- that it can be easily erected by not more than 2 persons;
- that it is insulated to protect the occupants against heat and cold by means of not less than 2 layers of material separated by an air gap or other equally efficient means, with provision to prevent accumulation of water in the air gap as applicable;
- that the exterior of the rigid cover and canopy, and the interior of that part of the lifeboat covered by the canopy, is of a highly visible color;
- that it has entrances at both ends and on each side, provided with efficient adjustable closing arrangements which can be easily and quickly opened and closed from the inside or outside so as to permit ventilation, but exclude seawater, wind and cold;
- that means shall be provided for holding the entrances securely in the open and closed positions;
- that with the entrances closed, it admits sufficient air for the occupants at all times;
- that it has means for the collection of rainwater; and,
- that the occupants can escape in the event of the lifeboat capsizing.

Fig 4.3 Partially enclosed lifeboat

4.1.4 Self – righting partially enclosed lifeboat

Self-righting partially enclosed lifeboats shall comply with all up mentioned requirements and in addition shall comply with the following requirements:

Enclosure

- every self righting partially enclosed lifeboat shall be provided with permanently attached rigid covers extending over not less than 20% of the length from the stem and not less than 20% of the length from the aftermost part of the lifeboat.

The rigid covers required shall form two shelters which shall:

- if they have bulkheads, have openings of sufficient size to permit easy access by persons, each wearing an immersion suit; and,
- be of sufficient interior height to permit persons easy access to their seats in the bow or stern of the lifeboat.

The rigid covers shall be so arranged that they include windows or translucent panels to admit sufficient daylight to the inside of the lifeboat with the openings and canopies closed so as to make artificial light unnecessary.

The rigid covers shall have railings attached to the outside of them to provide a secure handhold for persons moving about the exterior of the lifeboat.

Open parts of the lifeboat shall be fitted with a permanently attached folding canopy so arranged that it can be easily erected by not more than 2 persons in not more than 2 minutes and insulated to protect the occupants against heat and cold by means of not less than 2 layers of material separated by an air gap or other equally efficient means.

The enclosure formed by the rigid cover and canopy shall be so arranged:

- as to allow launching and recovery operations to be performed without any occupant having to leave the enclosure;
- that it has entrances at both ends and on each side, provided with efficient adjustable closing arrangements which can be easily and quickly opened and closed from the inside or outside so as to permit ventilation, but exclude seawater, wind and cold;
- means shall be provided for holding the entrances securely in the open and closed positions;
- that with the canopy erected and with the entrances closed, sufficient air is admitted for the occupants at all times;
- it has means for the collection of rainwater;
- that the exterior of the rigid covers and canopy and the interior of that part of the lifeboat covered by the canopy is of a highly visible color. The interior of the shelters shall be of a color which does not cause discomfort to the occupants; and

- that it is possible to row the lifeboat.

Capsizing and Re-righting

A safety belt shall:

- be fitted at each indicated seating position; and
- be so designed as to hold a person of a mass of 100 kg securely in place when the lifeboat is in a capsized position.

The stability of the lifeboat shall be such that it is inherently or automatically self-righting when loaded with its full or partial complement of persons and equipment and all entrances and openings are closed watertight, and the persons are secured with safety belts.

The lifeboat shall, in the event of capsizing, automatically attain a position that will provide an above water escape for its occupants.

The design of the engine exhaust pipes, air ducts, and other openings shall be such that water is excluded from the engine when the lifeboat capsizes and re-rights.

The lifeboat shall be automatically self-bailing.

Propulsion

The lifeboat engine and transmission be controlled from the helmsman position.

The engine and engine installation shall be capable of running in any position during capsize, and continue to run after the lifeboat returns to the upright, or, shall automatically stop on capsizing and be easily re-started after the lifeboat has returned to the upright and the water has been drained from the lifeboat.

The design of the lifeboat engine and lubricating systems shall prevent the loss of fuel and the loss of more than 250 ml of lubricating oil from the engine during capsize.

In addition a self-righting partially enclosed lifeboat shall be so constructed and fendered as to ensure that the lifeboat renders protection against harmful accelerations resulting from an impact of the lifeboat, when loaded with its full complement of persons and equipment, against the ship's side at an impact velocity of not less than 3.5 meters per second.

4.1.5 Totally enclosed lifeboats

Enclosure

- every totally enclosed lifeboat shall be provided with a rigid watertight enclosure which totally encloses the lifeboat.

The lifeboat enclosure shall be constructed and fitted so that:

- it protects the occupants against heat and cold;
- access into the lifeboat is provided by hatches which can be closed to make the lifeboat watertight;
- hatches are positioned so as to allow launching and recovery operations to be performed without any occupants having to leave the enclosure;
- access hatches are capable of being opened and closed from both inside and outside and are equipped with a means to hold them securely in the open position;
- it is possible to row the lifeboat;
- it is capable, when the lifeboat is in the capsized position with the hatches closed and without significant leakage, of supporting the entire mass of the lifeboat, including all equipment, machinery and its full complement of persons;
- it includes windows or translucent panels on both sides, which admit sufficient daylight to the inside of the lifeboat with the hatches closed, to make artificial light unnecessary;
- its exterior is of a highly visible color and its interior of a color which does not cause discomfort to the occupants;
- handrails provide a secure handhold for persons moving about the exterior of the lifeboat, and aid embarkation and disembarkation;
- persons have access to their seats from an entrance without having to climb over thwarts or other obstructions; and,
- the occupants are protected from the effects of dangerous sub-atmospheric pressures which might be created by the lifeboat's engine.

Fig.4.4 Totally enclosed lifeboat

4.1.6 Free-Fall lifeboat

Free-fall lifeboats shall comply with the requirements of totally enclosed lifeboats described above.

The carrying capacity of a free-fall lifeboat is the number of persons that can be provided with a seat without interfering with the means of propulsion or the operation of any of the lifeboat's equipment.

The width of the seat shall be at least 430 mm. Free clearance in front of the backrest shall be at least 635 mm. The backrest shall extend at least 1,000 mm above the seat pan.

Each free-fall lifeboat shall make positive headway immediately after water entry and shall not come into contact with the ship after a free-fall launching against a trim of up to 10° and a list of up to 20° either way from the certification height when fully equipped and loaded with:

- its full complement of persons;
- occupants so as to cause the centre of gravity to be in the most forward position;
- occupants so as to cause the centre of gravity to be in the most aft position;
- its operating crew only.

Each free-fall lifeboat shall be of sufficient strength to withstand, when loaded with its full complement of persons and equipment, a free-fall launch from a height of at least 1.3 times the free-fall certification height.

Each free-fall lifeboat shall be fitted with a release system which shall:

- have two independent activation systems for the release mechanisms which may only be operated from inside the lifeboat and be marked in a color that contrasts with its surroundings;
- be so arranged as to release the boat under any condition of loading from no load up to at least 200% of the normal load caused by the fully equipped lifeboat when loaded with the number of persons for which it is to be approved;
- be adequately protected against accidental or premature use;
- be designed to test the release system without launching the lifeboat;
- be designed with a factor of safety of 6 based on the ultimate strength of the materials used.

In addition to the requirements for fully enclosed lifeboat certificate of approval for a free-fall lifeboat shall also state:

- free-fall certification height;
- required launching ramp length; and
- launching ramp angle for the free-fall certification height.

Fig.4.5 Free-Fall lifeboats

4.1.7 Totally enclosed lifeboat with a self contained air support systems

The self-contained air support system shall be so arranged that when proceeding with all entrances and openings closed, the air within the lifeboat remains safe and breathable and the engine runs normally for a period of not less than 10 minutes.

During the period described (10 min) the atmospheric pressure inside the lifeboat shall never fall below the atmospheric pressure, nor shall it exceed it by more than 20 m/bar.

The self-contained air support system shall have provided visual indicators to indicate the pressure of the air supply within the system at all times.

4.1.8 Fire protected totally enclosed lifeboat

The lifeboat, when waterborne shall be capable of protecting the number of persons it is permitted to accommodate, when subjected to a continuous oil fire that envelops the lifeboat for a period of not less than 8 minutes.

Water spray system

A lifeboat that has fitted a water spray system shall comply with the following:

- water for the system shall be drawn from the sea by a self-priming motor pump, and it shall be possible to turn "on" and turn "off" the flow of water over the exterior of the lifeboat;
- the sea water intake shall be so arranged as to prevent the intake of flammable liquids from the sea surface; and,

- the system shall be arranged to allow flushing with fresh water, and complete draining.

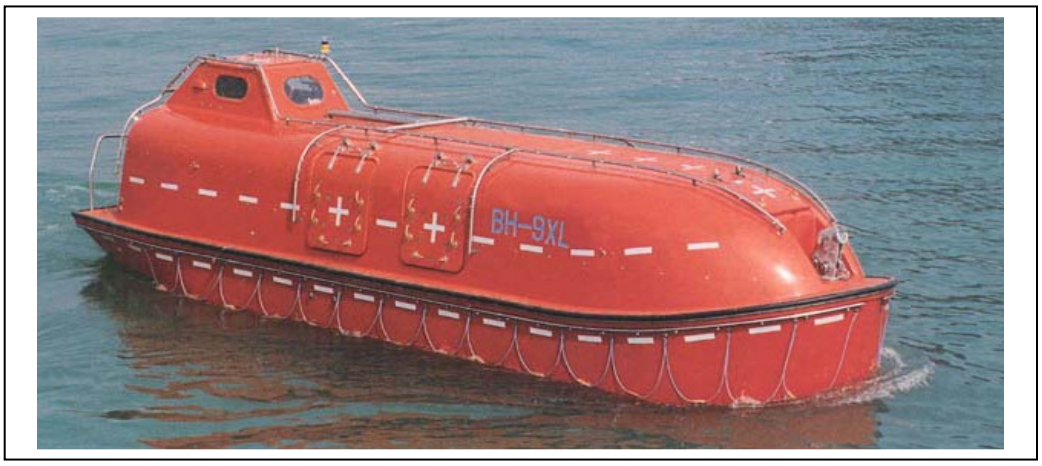


Fig. 4.6 Totally enclosed lifeboats with a self contained air support systems and fire protected

4.2 Liferafts

4.2.1 General requirements for liferafts

Construction of life-rafts

A life-raft must be so constructed as to be capable of withstanding exposure for 30 days afloat in all sea conditions.

A life-raft must be so constructed that when it is dropped into the water from a height of 18 meters, the life-raft and its equipment will operate satisfactorily. If the life raft is to be stowed at a height of more than 18 meters above the water-line in the lightest seagoing condition, it must be of a type which has been satisfactorily drop-tested from at least that height.

A floating life-raft must be capable of withstanding repeated jumps on to it from a height of at least 4.5 metes above its floor both with and without the canopy erected.

A life-raft and its fittings must be so constructed as to enable it to be towed at a speed of 3 knots in calm water when loaded with its full complement of persons and equipment and with one of its sea-anchors streamed.

A life-raft must have a canopy to protect the occupants from exposure which is automatically set in place when the life-raft is launched and waterborne.

The canopy must comply with the following:

- it must provide insulation against heat and cold by means of either 2 layers of material separated by an air gap or other equally efficient means. Means must be provided to prevent accumulation of water in the air gap;
- its interior must be of a color that does not cause discomfort to the occupants;
- each entrance must be clearly indicated and be provided with efficient adjustable closing arrangements which can be easily and quickly opened by persons clothed in immersion suits from inside and outside, and closed from inside, the life-raft so as to permit ventilation but exclude sea water, wind and cold.

A life-raft accommodating more than 8 persons must have at least 2 diametrically opposite entrances;

- it must admit sufficient air for the occupants at all times, even with the entrances closed;
- it must be provided with at least one viewing port;
- it must be provided with means for collecting rain water;
- it must be provided with means to mount a survival craft radar transponder at a height of at least 1 meter above the sea;
- it must have sufficient headroom for sitting occupants under all parts of the canopy.

Minimum carrying capacity and mass of life-raft

No life-raft will be approved which has a carrying capacity of fewer than 6 persons. The total mass of a life-raft, its container and its equipment must not be more than 185 kg.

Life-raft fittings

Lifelines must be securely around the inside and outside of a life-raft. A life-raft must be fitted with an efficient painter of length equal to not less than 10 meters plus the distance from the stowed position to the water-line in the lightest seagoing condition or 15 meters, whichever is the greater.

The breaking strength of the painter system, including its means of attachment to the life raft, except the weak link, must be:

- not less than 15.0 kN for life rafts permitted to accommodate more than 25 persons,
- not less than 10.0 kN for life rafts permitted to accommodate 9 to 25 persons
- not less than 7.5 kN for any other life raft.

A manually controlled lamp must be fitted to the top of the life raft canopy. The light must be white and be capable of operating continuously for at least 12 hours with a luminous intensity of not less than 4.3 candela in all directions of the upper hemisphere.

However, if the light is a flashing light it must flash at a rate of not less than

50 flashes and not more than 70 flashes per minute for the 12 hour operating period with an equivalent effective luminous intensity. The lamp must light automatically when the canopy is erected. Batteries must be of a type that does not deteriorate due to dampness or humidity in the stowed life raft.

A manually controlled lamp must be fitted inside the life raft capable of continuous operation for a period of at least 12 hours. It must light automatically when the canopy is erected and be of sufficient intensity to permit reading of survival and equipment instructions. Batteries must be of a type that does not deteriorate due to damp or humidity in the stowed life raft.

Fig. 4.7 Inflatable liferaft

4.2.2 Davit launched liferaft

In addition to the above requirements, a liferaft for use with a launching appliance must:

- when the life-raft is loaded with its full complement of persons and equipment, be capable of withstanding a lateral impact against the ship's side at an impact velocity of not less than 3.5 meters per second and also a drop into the water from a height of not less than 3 meters without damage that will affect its function; and
- be provided with means for bringing the life-raft alongside the embarkation deck and holding it securely during embarkation.

A passenger ship davit-launched life-raft must be so arranged that it can be rapidly boarded by its full complement of persons.

A cargo ship davit-launched life-raft must be so arranged that it can be boarded by its full of persons in no more than 3 minutes from the time the

instruction to board is given.

Fig.4.8 Davit launched liferaft

4.2.3 Equipment of the life raft

The normal equipment of a life-raft must consist of:

(a) a buoyant rescue quoit, attached to not less than 30 meters of buoyant line;

(b) a knife of the non-folding type having a buoyant handle and lanyard attached and stowed in a pocket on the exterior of the canopy near the point at which the painter is attached to the life-raft. In addition, a life-raft which is permitted to accommodate 13 persons or more must be provided with a second knife;

(c) for a life-raft which is permitted to accommodate:
  (i) no more than 12 persons = one buoyant bailer;
  (ii) 13 persons or more = 2 buoyant bailers;

(d) 2 sponges

(e) 2 sea-anchors each with a shock-resistant hawser and tripping line, one spare and other permanently attached to the life-raft in such a way that when the life-raft inflates, to lie oriented to the wind in the most stable manner. The sea-anchor must be fitted with a swivel at each end of the line and must be of a type which is unlikely to turn inside-out between its shroud lines. The sea-anchor permanently attached to davit-launched life rafts and life rafts fitted on passenger ships must be arranged for manual deployment only. All other life rafts are to

have the sea-anchor deployed automatically when the life raft inflates;

(f) 2 buoyant paddles;

(g) 3 tin openers and a pair of scissors. Safety knives containing special tin-opener blades are satisfactory for this requirement;

(h) a first-aid outfit in a waterproof case capable of being closed tightly after use;

(i) a whistle or equivalent sound signal;

(j) 4 rocket parachute flares;

(k) 6 hand flares;

(l) 2 buoyant smoke signals;

(m) a waterproof electric torch suitable for Morse signaling together with a spare set of batteries and a spare bulb in a waterproof container;

(n) an efficient radar reflector or survival craft radar transponder, and an EPIRB;

(o) a daylight signaling mirror with instructions on its use;

(p) a copy of the life-saving signals on a waterproof card or in a waterproof container;

(q) a set of fishing tackle sealed in a transparent plastic bag and must include at least:

- a line on a hand reel ready for use with sinker and hook fitted;
- a selection of at least 6 spare hooks; and
- a colored lure or spinner;

(r) a food ration of 10000 kJ;

(s) watertight receptacles containing a total of 1.5 liters of fresh water for each person the life-raft is permitted to accommodate, of which 0.5 liters per person may be replaced by a de-salting apparatus capable of producing an equal amount of fresh water in 2 days or 1 liter per person may be replaced by a manually powered reverse osmosis desalinator, capable of producing an equal amount of fresh water in 2 days;

(t) a rustproof graduated drinking vessel;

(u) 6 doses of anti-seasickness medicine and a seasickness bag for each person the life-raft is permitted to accommodate.

(v) instructions on how to survive;

(w) instructions for immediate action;

Float-free arrangements for life-rafts:

a) Painter system

The life-raft painter system must provide a connection between the ship and the life-raft and must be so arranged as to ensure that the life-raft when released and, in the case of an inflatable life-raft, inflated is not dragged under by the sinking ship.

b) Weak link

If a weak link is used in the float-free arrangement, it must:

(a) not be broken by the force required to pull the painter from the life-raft container;
(b) if applicable, be of sufficient strength to permit the inflation of the life-raft; and
(c) break under a strain of 2.2 +/- 0.4 Kilo Newton.

4.2.4 Hydrostatic release unit

If a hydrostatic release unit is used in the float-free arrangements, it must:

(a) be constructed of compatible materials so as to prevent malfunction of the unit. Galvanizing or other forms of metallic coating on parts of the hydrostatic release unit is not acceptable;
(b) automatically release the life-raft at a depth of not more than 4 meters;
(c) have drains to prevent the accumulation of water in the hydrostatic chamber when the unit is in its normal position;
(d) be so constructed as to prevent release when seas wash over the unit;
(e) be permanently marked on its exterior with its type and serial number;
(f) be permanently marked on the unit or identification plate securely attached to the unit stating the date of manufacture, type and serial number and whether the unit is suitable for use with a life raft with a capacity of more than 25 persons;
(g) be such that each part connected to the painter system has a

strength of not less than that required for the painter; and

(h) if of a disposable type, indicate in a way that cannot be removed the date by which it is to be replaced.

Fig.4.9 Different types of H.R.U.

Fig.4.10 Liferafts on the cradles with H.R.U.

4.2.5 Inflatable liferafts

Inflatable life raft must comply with the following provisions in addition to those up-mentioned.

a) Construction of inflatable life-rafts

The main buoyancy chamber must be divided into no fewer than 2 separate

compartments, each inflated through a non-return inflation valve on each compartment.

The buoyancy chambers must be so arranged that, in the event of any one of the compartments being damaged or failing to inflate, the intact compartments are able to support, with positive freeboard over the life-raft's entire periphery, the number of persons which the life-raft is permitted to accommodate, each having a mass of 75 kg and seated in their normal positions.

The floor of the life-raft must be waterproof and must be capable of being sufficiently insulated against cold either:

(a) by means of one or more compartments that the occupants can inflate, or which inflate automatically and can be deflated and re-inflated by the occupants; or

(b) by other equally efficient means not dependent on inflation.

The life raft must be capable of being inflated by one person. The life-raft must be inflated with a non-toxic gas. Inflation must be completed within a period of one minute at an ambient temperature of between 18°C and 20°C and within a period of 3 minutes at an ambient temperature of -30°C.

After inflation the life-raft must maintain its form when loaded with its full complement of persons and equipment.

Each inflatable compartment must be capable of withstanding a pressure equal to at least 3 times the working pressure and must be prevented from reaching a pressure exceeding twice the working pressure either by means of relief valves or by a limited gas supply.

b) Carrying capacity of inflatable life-rafts

The number of persons which a life-raft is permitted to accommodate is equal to the lesser of:

(a) the greatest whole number obtained by dividing by 0.096 the volume, measured in cubic meters, of the main buoyancy tubes (which for this purpose include neither the arches nor the thwarts if fitted) when inflated; or

(b) the greatest whole number obtained by dividing by 0.372 the inner horizontal cross-sectional area of the life-raft measured in square meters (which for this purpose may include the thwart or thwarts, if fitted) measured to the innermost edge of the buoyancy tubes; or

(c) the number of persons having an average mass of 75 kg, all wearing either immersion suits and lifejackets or, in the case of davit-launched life rafts, lifejackets, that can be seated with sufficient comfort and headroom without interfering with the operation of any of the life raft's equipment.

c) Access into inflatable life-rafts

At least one entrance must be fitted with a semi-rigid boarding ramp, capable of supporting a person weighing 100 kg, to enable persons to board the

life-raft from the sea so arranged as to prevent significant deflation of the life-raft if the ramp is damaged. In the case of a davit-launched life-raft having more than one entrance, the boarding ramp must be fitted at the entrance opposite the bowsing lines and embarkation facilities.

Entrances not provided with a boarding ramp must have a boarding ladder, the lowest step of which must be situated not less than 0.4 metres below the life-raft's light waterline.

There must be means inside the life-raft to assist persons to pull themselves into the life-raft from the ladder.

d) *Stability of inflatable life-rafts*

An inflatable life-raft must be so constructed that, when fully inflated and floating with the canopy uppermost, it is stable in a seaway.

The stability of the life-raft when in the inverted position must be such that it can be righted in a seaway and in calm water by one person.

The stability of the life-raft when loaded with its full complement of persons and equipment must be such that it can be towed at speeds of up to 3 knots in calm water.

The life raft must be fitted with water pockets complying with the following requirements:

(a) the water pockets must be of a highly visible color;

(b) the design must be such that the pockets fill to at least 60% of their capacity within 25 seconds of deployment;

(c) the pockets must have an aggregate capacity of at least 220 liters for life rafts up to 10 persons;

(d) the pockets for life rafts certified to carry more than 10 persons must have an aggregate capacity of not less than 20xN liters, where N = number of persons carried; and

(e) the pockets must be positioned symmetrically round the circumference of the life raft. Means must be provided to enable air to readily escape from underneath the life raft.

e) *Containers for inflatable life-rafts*

A life-raft must be packed in a container that is:

(a) so constructed as to withstand hard wear under conditions encountered at sea;

(b) as far as practicable watertight, except for drain holes in the container bottom.

A life-raft must be packed in its container in such a way as to ensure, as far as possible that the waterborne life-raft inflates in an upright position on breaking free from its container.

f) *The container must be marked with*:

(a) maker's name or trade mark;
(b) serial number;
(c) name of approving authority and the number of persons it is permitted to carry;
(d) SOLAS;
(e) type of emergency pack enclosed;
(f) date when last serviced;
(g) length of painter;
(h) maximum permitted height of stowage above water-line (depending on drop-test height and length of painter);
(i) launching instructions.

g) *Markings on inflatable life-rafts*

A life-raft must be marked with:

(a) maker's name or trade mark;
(b) serial number;
(c) date of manufacture (month and year);
(d) name of approving authority;

(e) name and place of servicing station where it was last serviced. Such marking is to be placed on a buoyancy tube inside the raft adjacent to a doorway;
(f) number of persons it is permitted to accommodate over each entrance in characters not less than 100 millimeters in height of a color contrasting with that of the life-raft;
(g) name and port of registry of the ship to which it is to be fitted, in such a form that the ship identification can be changed at any time without opening the container.

2 retro-reflective tapes not less than 50 millimeters wide must be placed on the underside of the floor of an inflatable life-raft in such a way that the tapes form a cross at the centre of the floor :
(a) in the case of a circular inflatable life-raft of a length that is not less than half the diameter of the life-raft; or
(b) in the case of any other inflatable life-raft of lengths that are not less than half the length and width, respectively, of the life-raft.

Fig. 4.11 Liferaft stowage containers

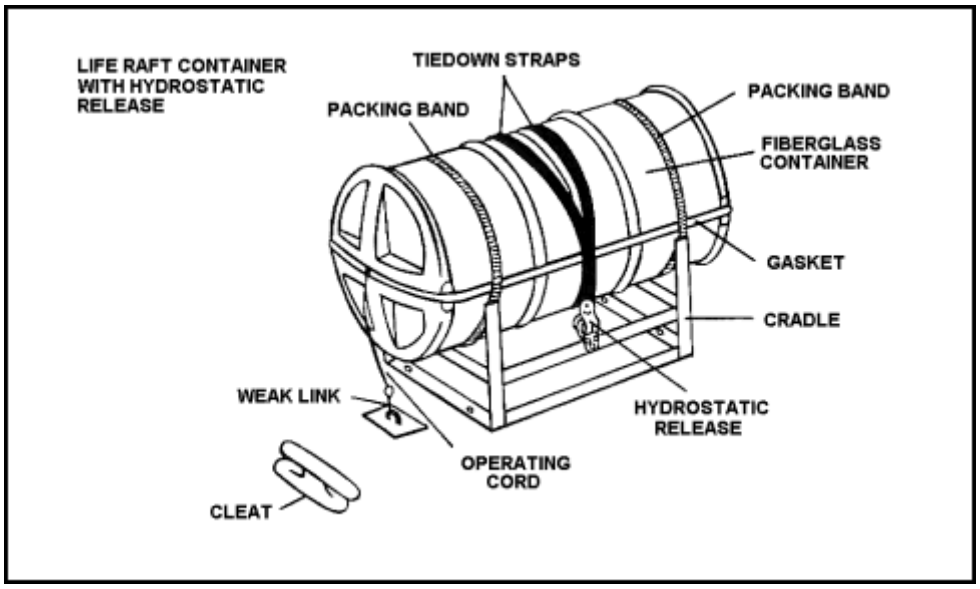


Fig. 4.12 Life raft container and hydrostatic release

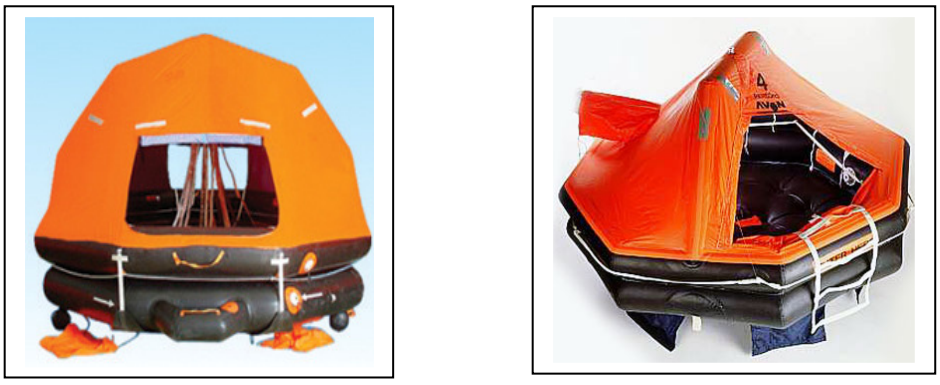


Fig.4.13 Inflatable liferaft

4.2.6 Rigid liferafts

Rigid liferafts shall comply with the requirements of section 4.2.1(General requirements for liferafts) and, in addition shall comply with the requirements of this section.

a) *Construction of rigid liferafts*

The buoyancy of a life-raft must be provided by approved inherently buoyant material placed as near as possible to the periphery of the life-raft.
The buoyant material must be fire-retardant or be protected by a fire-retardant covering.

The floor of a life-raft must prevent the ingress of water and must effectively support the occupants out of the water and insulate them from the cold.

b) *Carrying capacity of rigid life-rafts*

The number of persons which a life-raft is permitted to accommodate is equal to the lesser of:

(a) the greatest whole number obtained by dividing by 0.096 the volume, measured in cubic meters, of the buoyancy material multiplied by a factor of (1-SG) where SG is the specific gravity of that material; or

(b) the greatest whole number obtained by dividing by 0.372 the horizontal cross sectional area of the floor of the life-raft measured in square meters; or

(c) the number of persons having an average mass of 75 kg, all wearing immersion suits and life-jackets, that can be seated with sufficient comfort and headroom without interfering with the operation of any of the life-rafts equipment.

c) *Access into rigid life-rafts*

At least one entrance must be fitted with a rigid boarding ramp to enable persons to board the life-raft from the sea. In the case of a davit-launched life-raft having more than one entrance, the boarding ramp must be fitted at the entrance opposite to the bowing and embarkation facilities.

Entrances not provided with a boarding ramp must have a boarding ladder, the lowest step of which must be situated not less than 0.4 meters below the life-raft's light waterline.

There must be means inside the life-raft to assist persons to pull themselves into the life-raft from the ladder.

d) *Stability of rigid life-rafts*

Unless a life-raft is capable of operating safely whichever way up it is floating, its strength and stability must be such that it is either self-righting or can be readily righted in a sea way and in calm water by one person.

The stability of a life-raft when loaded with its full complement of persons and equipment must be such that it can be towed at speeds of up to 3 knots in calm water.

e) *Markings on rigid life-rafts*

A life-raft must be marked with:

(a) name and port of registry of the ship to which it belongs;
(b) maker's name or trade mark;
(c) serial number;
(d) name of approving authority;
(e) number of persons it is permitted to accommodate over each entrance in characters not less than 100 millimeters in height of a color contrasting with that of the life-raft;
(f) SOLAS;
(g) type of emergency pack enclosed;
(h) length of painter;
(i) maximum permitted height of stowage above water-line (drop-test height); and
(j) launching instructions.

Each canopy of a rigid life-raft must be fitted with retro-reflective tapes not less than 50 millimeters wide in such a way that:

(a) tapes not less than 300 millimeters long are spaced around the canopy so that the distance between the centre of a tape and the centre of the tape next in line is not greater than 500 millimeters and the distance between the lower edge of a tape and the lower edge of the canopy is not less than half the height of the canopy; and

(b) 2 tapes form a cross at the centre of the top of the canopy, the tapes being:

- on a circular life-raft of a length that is not less than half the diameter of the life-raft; and
- on any other life-raft of lengths that are not less than half the length and width, respectively, of the life-raft.

4.2.7 Stowed of liferafts

Every liferaft shall be stowed with its painter permanently attached to the ship.

Each liferaft or group of liferafts shall be stowed with a float-free

arrangement complying with the requirements of paragraph 4.1.6 (*Float-free arrangements for liferafts*) of the L.S.A.Code so that each floats free and, if inflatable, inflates automatically when the ship sinks.

Liferafts shall be so stowed as to permit manual release of one raft or container at a time from their securing arrangements.

The above aragraphs do not apply to liferafts required by regulation 31.1.4.(*Survival craft and rescue boats)* of the S.O.L.A.S. Convention.

Davit-launched liferafts shall be stowed within reach of the lifting hooks, unless some means of transfer is provided which is not rendered inoperable within the limits of trim and list prescribed in paragraph 1.2 (*Stowage of survival craft*) S.O.L.A.S. Convention only ship motion or power failure.

Liferafts intended for throw-overboard launching shall be so stowed as to be readily transferable for launching on either side of the ship unless liferafts, of the aggregate capacity required by regulation 31.1 (*Survival crafts*) of S.O.L.A.S. Convention to be capable of being launched on either side, are stowed on each side of the ship.

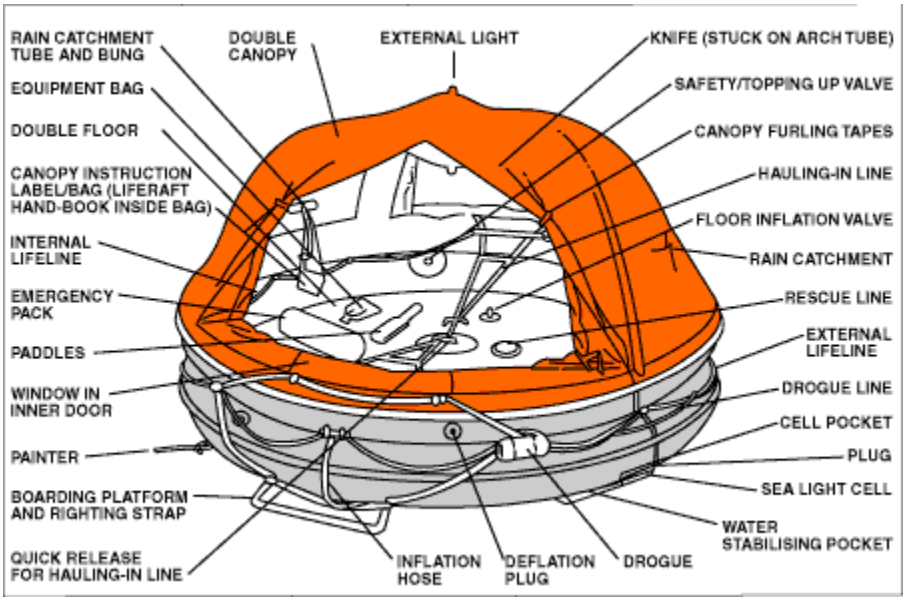


Fig. 4.14 Liferaft elements

4.3 Rescue boats

Chapter V, L.S.A.Code
Chapter III, S.O.L.A.S Convention

Passengers ships of 500 gross tonnage and over shall carry at least one rescue boat on each side of the ship.

Cargo ships shall carry at least one rescue boat; a rescue boat may be a lifeboat either of rigid or inflated construction or a combination of both.

a) *General requirements*

- be not less than 3.8 meters and not more than 8.5 meters in length; and
- be capable of carrying at least 5 seated persons and a person lying on a stretcher.

Unless a rescue boat has adequate sheer, it must be provided with a bow cover extending for not less than 15 % of its length.

A rescue boat must be capable of maneuvering at a speed of 6 knots and maintaining that speed for a period of at least 4 hours.

A rescue boat must have sufficient mobility and maneuverability in a seaway to enable persons to be retrieved from the water, marshal life-rafts and tow the largest life raft carried on a ship when loaded with its full complement of persons and equipment or its equivalent at a speed of at least 2 knots.

A rescue boat must be fitted with an inboard engine or outboard motor. If it is fitted with an outboard motor, the rudder and tiller may form part of the engine.

Arrangements for towing must be permanently fitted in a rescue boat and must be sufficiently strong to marshal or tow life-rafts.

Unless expressly provided otherwise, a rescue boat must be provided with effective means of bailing or be automatically self-bailing.

A rescue boat must be fitted with weather-tight stowage for small items of equipment.

b) *Rescue boat equipment*

All items of rescue boat equipment, with the exception of boat-hooks which must be kept free for fending off purposes, must be secured within the rescue boat by lashings, storage in lockers or compartments, storage in brackets or similar mounting arrangements, or other suitable means.

The equipment must be secured in such a manner as not to interfere with any launching or recovery procedures. All items of rescue boat equipment must be as small and of as little mass as possible and must be packed in suitable and compact form.

The normal equipment of a rescue boat must consist of:

(a) a sufficient number of buoyant oars or paddles to make headway in calm seas. Pins, crutches or equivalent arrangements must be provided for each oar. Pins or crutches must be attached to the boat by lanyards or chains;

(b) a buoyant bailer;

(c) a binnacle containing an efficient compass which is luminous or provided with suitable means of illumination;

(d) a sea-anchor and tripping line with a hawser of adequate strength not less than 10 meters in length;

(e) a painter of sufficient length and strength, attached to the release device and placed at the forward end of the rescue boat;

(f) a buoyant line, not less than 50 meters in length, of sufficient strength to tow a life raft

(g) a waterproof electric torch suitable for Morse signaling, together with a spare set of batteries and a spare bulb in a waterproof container;

(h) a whistle or equivalent sound signal;

(i) a first-aid outfit in a waterproof case capable of being closed tightly after use;

(j) 2 buoyant rescue quoits, attached to not less than 30 meters of buoyant line;

(k) a searchlight with a horizontal and vertical sector of at least 6° and a measured luminous intensity of 2500 candela which can work continuously for not less than 3 hours;

(l) an efficient radar reflector;.

(m) portable fire-extinguishing equipment.

In addition to the equipment up-mentioned, the normal equipment of a *rigid rescue boat* must include:

(a) a boat-hook;

(b) a bucket; and

(c) a knife or hatchet.

In addition to the equipment up-mentioned, the normal equipment of a *inflated rescue boat* must include:

(a) a buoyant safety knife;

(b) 2 sponges;

(c) an efficient manually operated bellows or pump;

(d) a repair kit in a suitable container for repairing punctures; and

(e) a safety boat-hook.

The following equipment, or other equally efficient means, must be fitted to assist the recovery of a lifeboat which is also a rescue boat in bad weather conditions:

(a) rope pennants attached to the lower fall blocks after launching is completed to enable the boat to be hung off, the rope pennants removed, and the lower blocks overhauled and attached to the boat so that it may be hoisted safely and expeditiously; and

(b) wire pennants attached to the davit heads to enable the boat to be brought up into its stowed position.

An inflated rescue boat must be so constructed as to be capable of withstanding exposure:

(a) when stowed on an open deck on a ship at sea; and

(b) for 30 days afloat in all sea conditions.

Inflated rescue boats must be marked with a serial number, the maker's name or trade mark and the date of manufacture.

The buoyancy of an inflated rescue boat must be provided by either a single tube subdivided into at least five separate compartments of approximately equal volume or two separate tubes.

The buoyancy tubes must be so arranged that the intact compartments must be able to support the number of persons which the rescue boat is permitted to accommodate, each having a mass of 75 kilograms, when seated in their normal positions with positive freeboard over the rescue boat's entire periphery under the following conditions:

(a) with the forward buoyancy compartment deflated;

(b) with the entire buoyancy on one side of the rescue boat deflated; and

(c) with the entire buoyancy on one side and the bow compartment deflated.

The buoyancy tubes forming the boundary of an inflated rescue boat must on inflation provide a volume of not less than 0.17 cubic meters for each person the rescue boat is permitted to accommodate.

Each buoyancy compartment must be fitted with a non-return valve for manual inflation and means for deflation. A safety relief valve must also be fitted.

An inflated rescue boat must be maintained at all times in a fully inflated condition.

c) *Marking of rescue boats*

An inflated rescue boat must be fitted:

(a) on the outside of the boat, arranged vertically with the lower edge at the waterline, with retro-reflective tapes, each tape being not less than 150 millimeters long and not less than 50 millimeters wide, spaced so that the distance between the centre of a tape and the centre of the tape next in line is not greater than 500 millimeters;

(b) on the bow, with a vertical strip of retro-reflective tape 600 millimeters long and 50 millimeters wide and two horizontal strips of retro-reflective tape 150 millimeters long and 50 millimeters wide, these strips being placed in the form of an arrowhead;

(c) on the transom, above the water-line, with retro-reflective tapes, each tape being not less than 150 millimeters long and not less than 100 millimeters wide;

(d) on each float, with retro-reflective tapes, each tape being not less than 150 millimeters long and not less than 50 millimeters wide, spaced so that the distance between the centre of a tape and the centre of the tape next in line is not less than 500 millimeters;

(e) at the rear of each float, with a retro-reflective tape, being not less than 300 millimeters long and not less than 50 millimeters wide;

(f) on each side of the bow cover, with retro-reflective tapes forming a cross, each tape being not less than 300 millimeters long and not less than 50 millimeters wide; and

(g) on the underside of the boat, with retro-reflective tapes, each tape being not less than 300 millimeters long and not less than 50 millimeters wide, spaced so that the distance between the centre of a tape and the centre of the tape next in line is not less than 500 millimeters.

d) *Stowage of rescue boats*

Rescue boats shall be stowed:

- in a state of continuous readiness for launching in not more than 5 min;
- in a position suitable for launching and recovery;
- so that neither the rescue boat nor its stowage arrangements will interfere with the operation of any survival craft at any other launching station;
- if it is also a lifeboat, in compliance with the requirements of regulation 13 (*Stowage of survival craft*) of S.O.L.A.S. Convention.

Fig. 4.15 Semi-rigid rescue boat

Fig. 4.16 Rigid rescue boat

Fig. 4.17 Inflatable rescue boat

e) *Requirements for the carriage of survival craft and rescue*

Regulation 21.2 of S.O.L.A.S. Convention
Survival craft and rescue boats (Passenger Ships)

- Passenger ships of 500 gross tonnage and over shall carry at least one rescue boat complying with the requirements of section 5.1 of the Code on each side of the ship.
- Passenger ships of less than 500 gross tonnage shall carry at least one rescue boat complying with the requirements of section 5.1 of the Code.
- A lifeboat may be accepted as a rescue boat provided it also complies with the requirements for a rescue boat.

Regulation 31.2 of S.O.L.A.S Convention
Rescue boats (Cargo ship)

Cargo ships shall carry at least one rescue boat complying with the requirements of section 5.1 of the Code. A lifeboat may be accepted as a rescue boat, provided that it also complies with the requirements for rescue boat.

In addition to their lifeboats, all cargo ships constructed before 1 July 1986 shall carry:

- one or more liferafts capable of being launched on either side of the ship and of such aggregate capacity as will accommodate the total number of persons on board. The liferaft or liferafts shall be equipped with a lashing or an equivalent means of securing the liferaft which will automatically release it from a sinking ship;
- where the horizontal distance from the extreme end of the stem or stern of the ship to the nearest end of the closest survival craft is more than 100 m, in addition to the liferafts required by above paragraph, a liferaft stowed as far forward or aft, or one as far forward and another as hr aft, as is reasonable and practicable.

Notwithstanding the requirements of above paragraph , such liferaft or liferafts may be securely fastened so as to permit manual release.

4.4 Fast rescue boats

A fast rescue boat may be provided in place of a standard rescue boat.

a) *General requirements*

A fast rescue boat may be either of rigid, inflated or rigid/inflated construction and must:

(a) be of a length adequate for its intended use; and

(b) be capable of carrying at least five seated persons and a person lying down.

A fast rescue boat must be self-righting or capable of being readily righted by its crew. Unless the fast rescue boat has adequate sheer, it must be provided with a bow cover extending for not less than 15% of its length, and be self-bailing or capable of being rapidly cleared of water.

A fast rescue boat must be capable of maneuvering, for at least 4 hours, at a speed of at least 20 knots in calm water with a suitably qualified and experienced crew of at least 3 persons and at least 8 knots with a full complement of persons and equipment.

A fast rescue boat must have sufficient mobility and maneuverability in a seaway to enable persons to be retrieved from the water, marshal life-rafts and tow the largest life-raft carried on the ship when loaded with its full complement of persons and equipment or its equivalent at a speed of at least 2 knots.

A fast rescue boat must be fitted with an inboard engine or engines or an outboard motor or motors commensurate with its speed, size and displacement. It should be steered by a wheel which is remote from the rudder, water jet or jets and outboard motor or motors and an approved form of emergency steering must be fitted.

Each engine or motor in a fast rescue boat must stop automatically or be stopped by the helmsman's emergency release switch should the boat capsize.
When the boat has righted, each engine or motor must be capable of being restarted, provided the helmsman's emergency release, if fitted, has been reset.

Arrangements for towing must be permanently fitted in fast rescue boats and should be sufficiently strong to marshal or tow life-rafts.

A fast rescue boat must be fitted with weather tight stowage for small items of equipment.
If a fast rescue boat is stowed on a ship, a disengaging gear must be fitted.

b) *Fast rescue boat equipment*

All items of fast rescue boat equipment, with the exception of boat-hooks which should be kept free for fending off purposes, must be secured within the rescue boat by lashings, storage in lockers or compartments, storage in brackets or similar mounting arrangements, or other suitable means. The equipment must be secured in such a manner as not to interfere with any launching or recovery procedures. All items of fast rescue boat equipment must be as small and of as little mass as possible and must be packed in suitable and compact form.

The normal equipment of every fast rescue boat must consist of:

(a) sufficient buoyant oars or paddles to make headway in calm seas. Thole pins, crutches or equivalent arrangements must be provided for each oar and be attached to the boat by lanyards or chains;
(b) a buoyant bailer;
(c) a binnacle containing an efficient compass which is luminous or provided with suitable means of illumination;
(d) a sea-anchor with a hawser of adequate strength not less than 10 meters in length;
(e) a painter of sufficient length and strength, attached to the release device and placed at the forward end of the fast rescue boat;
(f) one buoyant line, not less than 50 meters in length, of sufficient strength to tow a life-raft;
(g) one waterproof electric torch suitable for Morse signaling, together with one spare set of batteries and one spare bulb in a waterproof container;
(h) one whistle or equivalent sound signal;
(i) a first-aid outfit;
(j) two buoyant rescue quoits, attached to not less than 30 meters of buoyant line;
(k) a searchlight capable of effectively illuminating a light-colored object at night having a width of 18 meters at a distance of 180 meters for a total period of 6 hours and of working for at least 3 hours continuously;
(l) unless a radar transponder is stowed in the fast rescue boat, an efficient radar reflector;

(m) thermal protective aids sufficient for 10% of the number of persons the rescue boat is permitted to accommodate or 2, whichever is the greater;

(n) portable fire-extinguishing equipment of an approved type suitable for extinguishing oil fires.

In addition to the equipment up-mentioned, the normal equipment of every *rigid fast rescue boat* must include:

(a) a boat-hook;
(b) a bucket; and
(c) a knife or hatchet.

In addition to the equipment up-mentioned, the normal equipment of every *rigid/inflated and every inflated fast rescue boat* must include:

(a) a buoyant safety knife;
(b) two sponges;
(c) an efficient manually-operated bellows or pump;
(d) a repair kit in a suitable container for repairing punctures; and
(e) a safety boat-hook.

A fast rescue boat must be equipped with an easily operated fixed single-point suspension arrangement or equivalent.

Hooks and fastening devices for lowering and hoisting fast rescue boats must be so designed as to have a safety factor of 6 on the ultimate strength in relation to the loads occurring in a fully loaded condition.

Fig.4.18 Fast rescue boats in action

5. Launching arrangements

5.1 Boat davits

5.1.1 Life Saving Appliance Code provisions

(Chapter VI Launching and embarkation appliances)

a) *General requirements*

With the exception of the secondary means of launching for freefall lifeboats, each launching appliance shall be so arranged that the fully equipped survival craft or rescue boat it serves can be safely launched against unfavourable conditions of trim of up to 10˚ and a list of up to 20˚either way:

a) when embarked as required with its full complement of persons;

b) with not more than the required operating crew on board.

Notwithstanding the requirements of paragraph (a) above, lifeboat launching appliances for oil tankers chemical tankers and gas carriers with a final angle of heel greater than 20˚ calculated in accordance with the International Convention for the Prevention of Pollution from Ships,1973, as modified by the 1978 Protocol, shall be capable of operating at the final angle of heel on the lower side of the ship.

A launching appliance shall not depend on any means other than gravity or stored mechanical power which is independent of the ship's power supplies to launch the survival craft or rescue boat it serves in the fully loaded and equipped condition and also in the light condition.

Each launching appliance shall be so constructed that only a minimum amount of routine maintenance is necessary. All parts requiring regular maintenance by the ship's crew shall be readily accessible ano easily maintained.

The launching appliance and its attachments other than winch brakes shall be of sufficient strength to withstand astatic proof load on test of not less than 2.2 times the maximum working load.

Structural members and all blocks, falls, padeyes, links, fastenings and all other fittings used in connection with launching equipment shall be designed with a factor of safety on the basis of the maximum working load assigned and the ultimate strengths of the materials used for construction. A minimum factor of safety of 4.5 shall be applied to all structural members, and a minimum factor of safety of 6 shall be applied to falls, suspension chains, links and blocks.

Each launching appliance shall, as far as practicable, remain effective under conditions of icing.

A lifeboat launching appliance shall be capable of recovering the lifeboat with its crew.

Each rescue boat launching appliance shall be fitted with a powered winch motor capable of raising the rescue boat from the water with its full rescue boat complement of persons and equipment at a rate of not less than 0.3 m/s.

The arrangements of the launching appliance shall be such as to enable safe boarding of the survival craft in accordance with the requirements of paragraphs 4.1.4.2, 4.1.4.3, 4.4.3.1 and 4.4.3.2 of the L.S.A.Code.

b) *Launching appliances using falls and a winch*

The launching mechanism shall be so arranged that it may be actuated by one person from a position on the ship's deck and, except for secondary launching appliances for free-fall lifeboats from a position with in the survival craft or rescue boat. When launched by a person on the deck, the survival craft or rescue boat shall be visible to that person.

Falls shall be of rotation resistant and corrosion resistant steel wire rope.

In the case of a multiple-drum winch, unless an efficient compensatory device is fitted, the falls shall be so arranged as to wind off the drums at the same rate when lowering, and to wind on to the drums evenly at the same rate when hoisting.

The winch brakes of a launching appliance shall be of sufficient strength to withstand:

a) a static test with a proof load of not less than 1.5 times the maximum working load;

b) a dynamic test with a proof load of not less than 1.1 times the maximum working load at maximum lowering speed.

An efficient hand gear shall be provided for recovery of each survival craft and rescue boat. Hand-gear handles or wheels shall not be rotated by moving parts of the winch when the survival craft or rescue boat is being lowered or when it is being hoisted by power.

Where davit arms are recovered by power, safety devices shall be fitted which will automatically cut off the power before the davit arms reach the stops in order to prevent overstressing the falls or davits, unless the motor is designed to prevent such overstressing.

The speed at which the fully loaded survival craft or rescue boat is lowered to the water shall not be less than that obtained from the formula:

$$S = 0.4 + 0.02 \times H$$

where:

* S is the lowering speed in metres per second
* H is the height in metres from the davit head to the waterline with the ship in the lightest sea-going condition.

The maximum lowering speed shall be established by the Administration having regard to the design of the survival craft or rescue boat, the protection of its occupants from excessive forces, and the strength of the launching arrangements taking into account inertia forces during an emergency stop

Every launching appliance shall be fitted with brakes capable of stopping the descent of the survival craft or rescue boat and holding it securely when

loaded with its full complement of persons and equipment; brake pads shall, where necessary, be protected from water and oil.

Manual brakes shall be so arranged that the brake is always applied unless the operator, or a mechanism activated by the operator, holds the brake control in the "off" position.

c. Float-free launching

Where a survival craft requires a launching to float free, the float-free release of the position shall be automatic.

d. Launching appliances for free-fall lifeboats

Every free-fall launching appliance shall comply with the General Requirements and, in addition, shall comply with the following requirements:

- The launching appliance shall be designed and installed so that it and the lifeboat it serves operate as a system to protect the occupants from harmful acceleration forces and to ensure effective clearing of the ship.
- The launching appliance shall be constructed so as to prevent sparking and incendiary friction during the launching of the lifeboat.
- The launching appliance shall be designed and arranged so that, in its ready-to-launch position, the distance from the lowest point on the lifeboat it serves to the water surface with the ship in its lightest seagoing condition does not exceed the lifeboat's free-fall certification height.
- The launching appliance shall be arranged so as to preclude accidental release of the lifeboat in its unattended stowed position. If the means provided to secure the lifeboat cannot be released from inside the lifeboat, it shall be so arranged as to preclude boarding the lifeboat without first releasing it.

5.1.2 Gravity davits

Gravity davits are any davits which use the weight of the boat to do the work required to launch the boat overside; they may operate on pivots or have a carriage mounted on roller-track ways which are fixed either to the deck or overhead.

The boat is launched by the lifting of a brake handle. The brake is required to apply itself automatically immediately the handle is released by the brake operator.

The rate of the boat's descent is controlled by an independent centrifugal brake.

These davits are all fitted with wire rope falls and winches.

They are required to be fitted with tricing pendants to bring the boat alongside and bowsing-in tackles to replace the tricing pendants and keep the survival craft alongside. The tricing pendants must always be released and the

weight of the boat transferred to the falls before persons are embarked in the boat.

Fig. 5.1 Gravity davit

Gravity davits are provided with a safety device which will prevent the davits from operating while it is in position. This device usually takes the form of a trigger to which the gripes are attached and is so adjusted that while the gripes are "on", the davits cannot operate.

In addition, holes are being inadvertently operated in port. These bolts, known as "Harbour safety pins "are to be shipped only in port.

When the falls and winches are being overhauled the lifeboat must be floated or landed before the falls are let go for overhauling.

Harbour safety pins are always to be unshipped before the vessel proceed to sea, so that the boats are at all times ready for immediate use.

Gravity davit "Miranda "System

The boat is contained in and attached to a cradle that is hoisted to the davit head by means of two single wire rope falls; there are therefore no floating blocks. The boat is attached to the cradle by means of two short wire straps placed between the cradle head and the boat's lifting hooks. The painter whinch is attached to the lifeboat by means os a quick release system is also attached to the cradle and not to the ship.

The davits is static and contain no moving parts except the sheaves. The gripes clear automatically as the boat is lowered by means of the control wire, which is also situated at the helmsman's position. No bowsing-in tackles or tricing pendants are required.

5.1.3 Luffing davits

Luffing davits require the boat to be taken from inboard to outboard by the manual turning of a worm screw or telescope screw.

These davits are required to be capable of launching a boat against an adverse list of 15˚ and like gravity davits, are fitted in pairs.

The boat normally rests in chocks at deck level and is firmly held down by means of deck gripes.

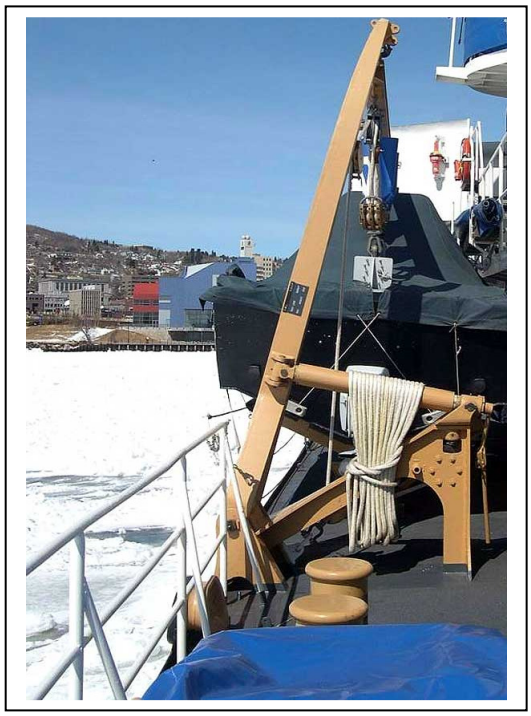


Fig. 5.2 Luffing davit

5.1.4 Single arm davits

Single arm davits are mechanically controlled and are required to befitted with wire falls and a winch. They may be sited on the stern of small vessels attached to a lifeboat or rescue boat. Inflated boats will be secured at an approved position by approved fastenings.

Single arm davits attached to boats are normally required to be able to launch the boat on one side of the ship only and are not required to launch the boat against an adverse list.

Two men only are to be in the boat while it is being launched. Survivors join the boat when it is afloat.

Single arm davit may also be placed amidship for launching and recovery of inflatable boats and for the launching of liferafts. When intend for use with liferafts, the fall is require to have a tricing line attached for the purpose of

recovering the hook after a liferaft has been launched, without turning the davit inboard.

They shall also be fitted with a safety hook, which when the safety catch is released, will automatically release the liferaft as soon as it is waterborne. In lieu of a winch, some single arm davits intended for launching liferafts will be fitted with a spring motor for automatic recovery of the fall.

Fig. 5.3 Single arm davits

5.1.5 Tricing pendants

Tricing pendant are attached to the floating blocks of the falls on gravity davits and to the shoulders of the davits themselves. Having been made a pre-determined length, they will bring the boat alongside when it is lowered to the embarkation deck.

Made of wire, they incorporate a strong rope lashing between the end of the wire pendant and a senhouse slip, to allow it to be cut in an emergency.

The shackle attaching the senhouse slip to the floating block is required to be elongated, so that it is impossible for the tongue of the senhouse slip or the link holding the tongue, to be jammed against the floating block.

The link of the senhouse slip is secured in position by a wood safety pin, should this pin become wet and swell it is easily broken. Steel pins are not to be used for this purpose because they are liable to rust in place.

Care must be taken when lowering the boat, not to let it over-run and so place an undue load on the tricing pendants. Bowsing-in tackles are to be made fast to the floating blocks and the ship's side, hauled tight and made fast and the tricing pendants released before persons are allowed to embark. A true senhouse slip is embodied in the tricing pendants to facilitate the operation of letting them go while there may be a certain amount of weight of them.

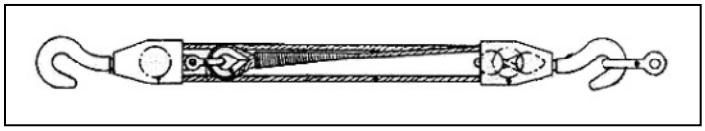


Fig. 5.4 Bowsing-in tackles

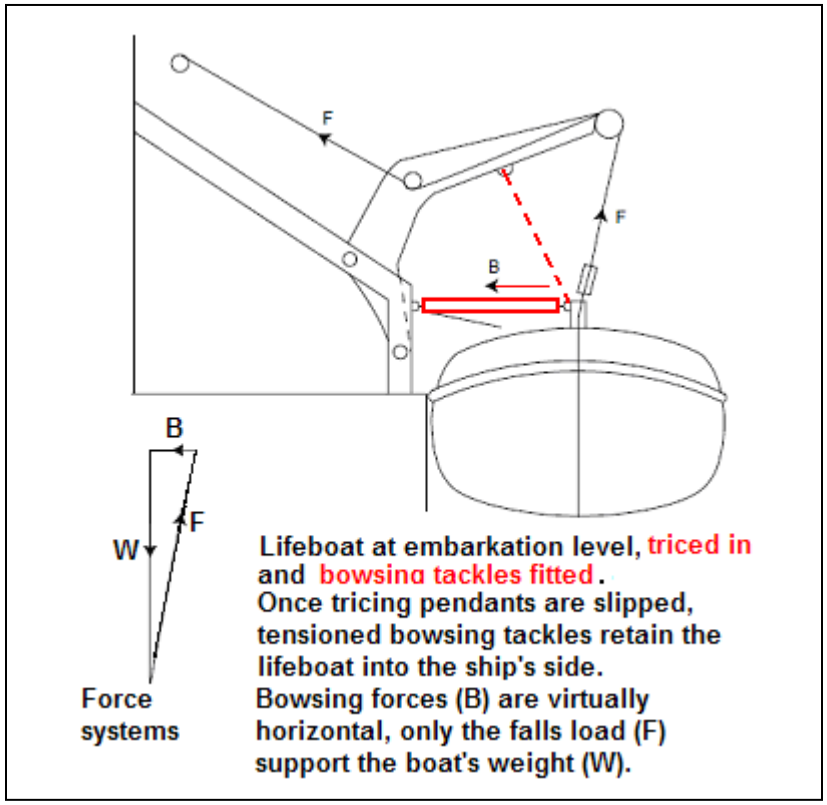

F
F
B
B
W
F
Force systems
Lifeboat at embarkation level, triced in and bowsing tackles fitted.
Once tricing pendants are slipped, tensioned bowsing tackles retain the lifeboat into the ship's side.
Bowsing forces (B) are virtually horizontal, only the falls load (F) support the boat's weight (W).

Fig. 5.5 Bowsing-in tackles and force systems

5.1.6 Gripes

The function of the gripes is to hold the boat firmly down in the chocks or in the case of gravity davits, firmly against the shoulder chocks of the davits.

Gripes are required to be fitted so that they can be let-go from inboard. The normal method of fitting is to have the gripe wires taken over fairleads on the gunwale and fastened on the outboard side to the deck or davit frame, a senhouse slip is attached to the inboard end of the gripes for letting-go.

A strong rope lashing is incorporated next to the senhouse slip to allow it to be cut in an emergency. Care must be taken as the boat is turned out, that the thimble on the inboard end of the gripes, which has to pass over the boat, does not foul anything. It is the responsibility of the two men in the boat to clear the

gripes. On gravity davits it is the responsibility of the men who let-go the gripes to ensure that when a trigger is fitted, it does in fact fall.

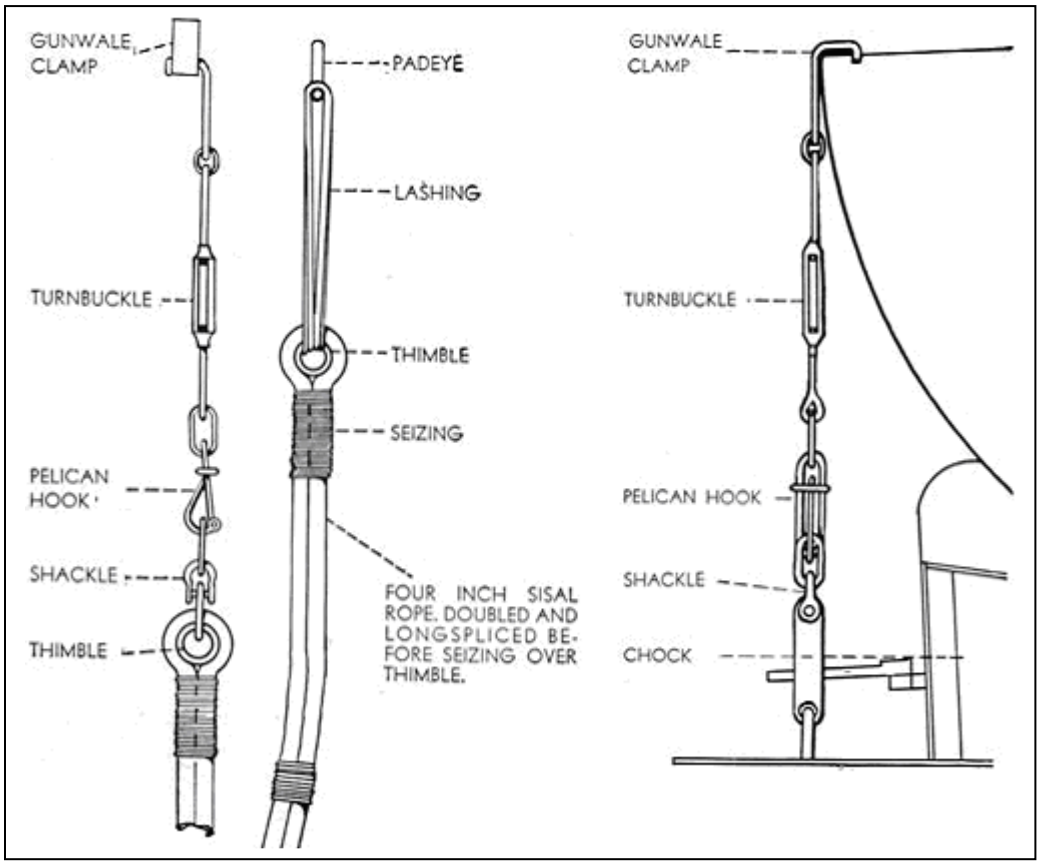


Fig. 5.7 The gripes

5.1.7 Skates

Every lifeboat attached to davits, except emergency lifeboat and rescue boats, is fitted with two skates on the inboard side, for the purpose of assisting the passage of the boat down the side of a ship with an adverse list.

That is to say, the skates are there to act as skids and help slide or skates the boat down the side of the ship.

When the boat is in the water, the skates ceases to have any value and will greatly hamper the movement of the boat. Therefore, as soon as it may be convenient, unship them and tow them.

5.1.8 On board maintenance

S.O.L.A.S., Chapter III

R 20 Operational readiness, maintenance and inspection

Before the ship leaves port and at all times during the voyage, all life-saving appliances shall be in working order and ready for immediate use.

Instructions for on-board maintenance of life-saving appliances complying with the requirements of regulation 36 shall be provided and maintenance shall be carried out accordingly.

The Administration may accept, in lieu of the instructions required by above paragraph, a shipboard planned maintenance programme.

Falls used in launching shall be turned end for end at intervals of not more than 30 months and be renewed when necessary due to deterioration of the falls or at intervals of not more than five years, whichever is the earlier.

The Administration may accept in lieu of the "end for ending" required in above paragraph, periodic inspection of the falls and their renewal whenever necessary due to deterioration or at intervals of not more than four years, whichever one is earlier.

Spares and repair equipment shall be provided for life-saving appliances and their components which are subject to excessive wear or consumption and need to be replaced regularly.

Weekly inspection:

- all survival craft, rescue boats and launching appliances shall be visually

inspected to ensure that they are ready for use;

- all engines in lifeboats and rescue boats shall be run for a total period of not less than 3 min provided the ambient temperature is above the minimum temperature required for starting and running the engine. During this period of time, it should be demonstrated that the gear box and gear box train are engaging satisfactorily. If the special characteristics of an outboard motor fitted to a rescue boat would not allow it to be run other than with its propeller submerged for a period of 3 min, it should be run for such period as prescribed in the manufacturer's handbook;
- the general emergency alarm system shall be tested.

Monthly inspections

- Inspection of the life-saving appliances, including lifeboat equipment, shall be carried out monthly using the checklist to ensure that they are complete and in good order. A report of the inspection shall be entered in the log-book.

R 36 Instructions for on-board maintenance

Instructions for on-board maintenance of life-saving appliances shall be easily understood, illustrated wherever possible, and, as appropriate, shall include the following for each appliance:

- a checklist for use when carrying out the inspections required;
- maintenance and repair instructions;
- schedule of periodic maintenance;
- diagram of lubrication points with the recommended lubricants;
- list of replaceable parts;
- list of sources of spare parts;
- log for records of inspections and maintenance.

See also the attached MSC.1/Circ.1206/Rev.1 , 11 June 2009 : " Measures to prevent accidents with lifeboats.

5.2 Liferaft davits

5.2.1 Life Saving Appliance Code provisions

(Chapter VI Launching and embarkation appliances)

Liferaft launching appliances

Every liferaft launching appliance shall comply with the requirements, except with regard to embarkation in the stowed position, recovery of the loaded liferaft and that manual operation is permitted for turning out the appliance. The launching
appliance shall include an automatic release hook arranged so as to prevent premature release during lowering and shall release the liferaft when waterborne. The release hook shall include a capability to release the hook under load. The
on-load release control shall:

- be clearly differentiated from the control which activates the automatic release function;
- require at least two separate actions to operate;
- with a load of 150 kg on the hook, require a force of at least 600 N and not more than 700'N to release the load, or provide equivalent adequate protection against inadvertent release of the hook.
- be designed such that the crew members on deck can clearly observe when the release mechanism is properly and completely set.

5.2.2 Liferaft launching davits

See 5.1.4 for single arm davits.

Davit-launched liferafts shall be stowed within reach of the lifting hooks, unless some means of transfer is provided which is not rendered inoperable within the limits of trim and list.

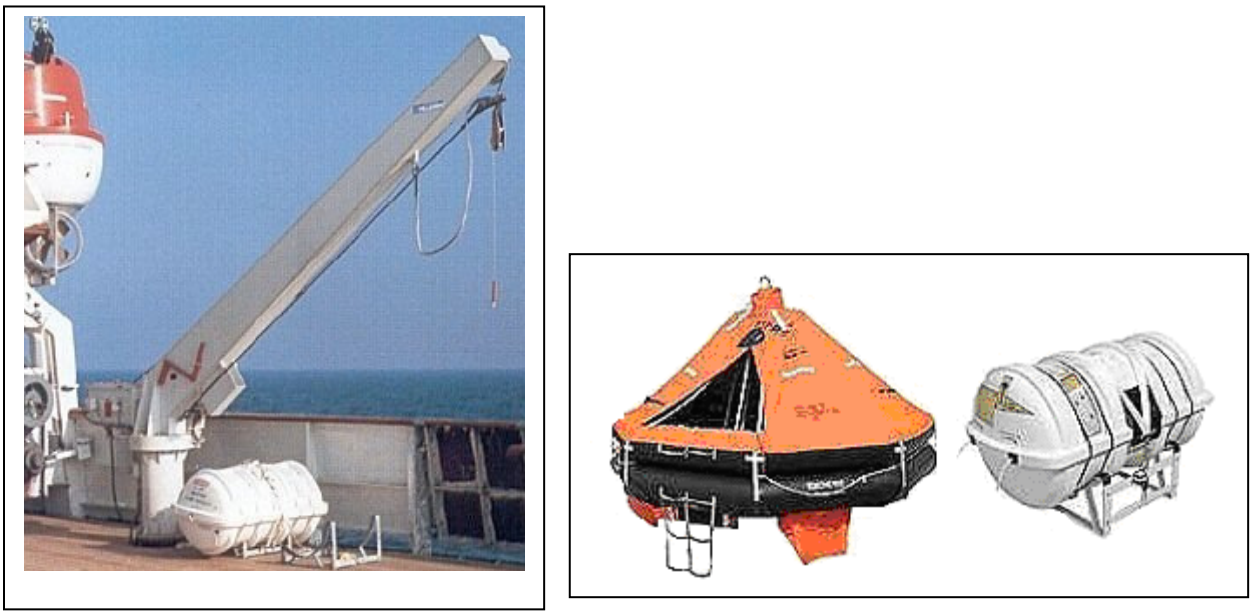


Fig.5.8 The single arm davit and servicing liferaft

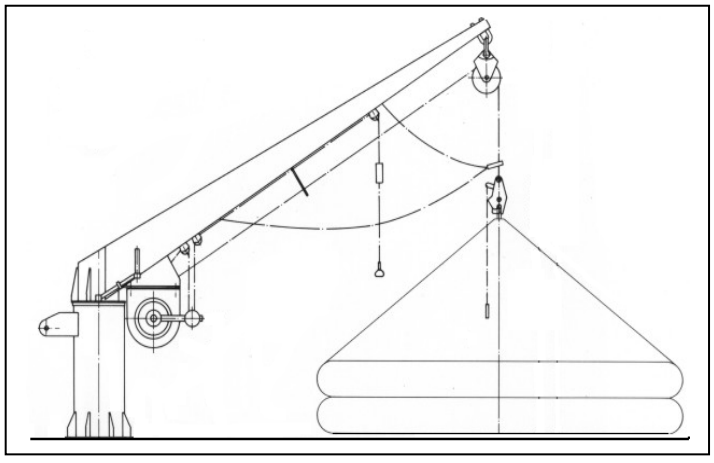


Fig. 5.9 The liferaft launching davit simple scheme

The davit arrangements are included in the life-saving equipment of vessel and are intended for gravity launching of life raft with set of occupants onto water. The life rafts are pulled from deck outboard vessel after the

unloaded outrigger has been slewed. The davit arrangements operate at vessel's heel up to 20° at-either side and trim up to 10°.

5.2.3 Automatic release hook

The primary aim in fitting these particular types of release equipment is to facilitate the safe release of the rafts and boats from the davit falls during an evacuation, especially in heavy weather conditions.

Whilst this type of release equipment represents a great technical advance over the traditional hook, which has been used for so many years, it is also much more complex. Consequently, to ensure that it will always function efficiently, it must be properly adjusted, regularly maintained and correctly operated at all times. Of particular importance is the need to ensure that the correct design of ring or shackle is being used to connect the release equipment to the davit falls. Failure to attend to any of these factors could cause a malfunction of the release equipment, resulting in the raft or boat being released prematurely or, alternatively, being retained on the falls when waterborne, with potentially disastrous results in either case.

Unfortunately several serious accidents involving the use of these release mechanisms have already been reported , they include:—

(a) premature release of lifeboats from the falls; causing death and serious injuries to the occupants and extensive damage to the boats;

(b) retention of a lifeboat on the falls when waterborne; the occupants were uninjured but great difficulties were experienced in releasing the boat;

(c) premature release of davit launched liferafts from the falls; causing loss of confidence to members of the crew witnessing the launches and also damage to the rafts.

The testing to be conducted in the following manner:

(a) the operation of automatic release hooks for liferafts - by suspending an appropriate weight; setting the hook and then lowering the weight to the deck where it should be automatically released;

(b) the operation of “on-load” disengaging gear and “off-load” release mechanisms - by lowering the boat into the water and then pulling on the control lever after which the hooks should open. It should be noted that this equipment should never be tested whilst the boat is hanging in the davits.

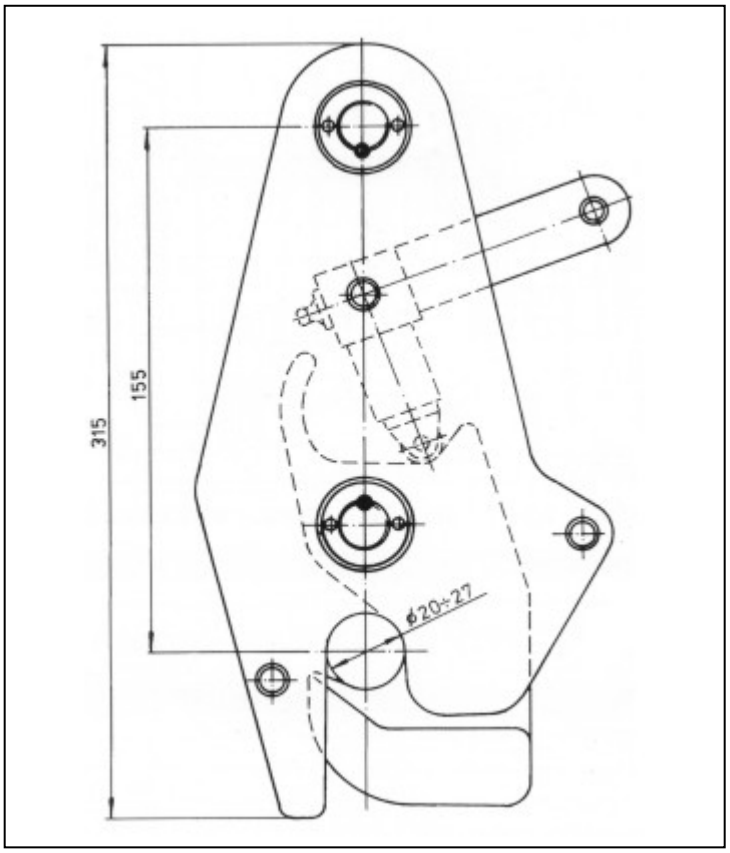


Fig. 5.9 Automatic release hook scheme

Fig. 5-10 Automatic release hooks

5.3 Rescue boat davits

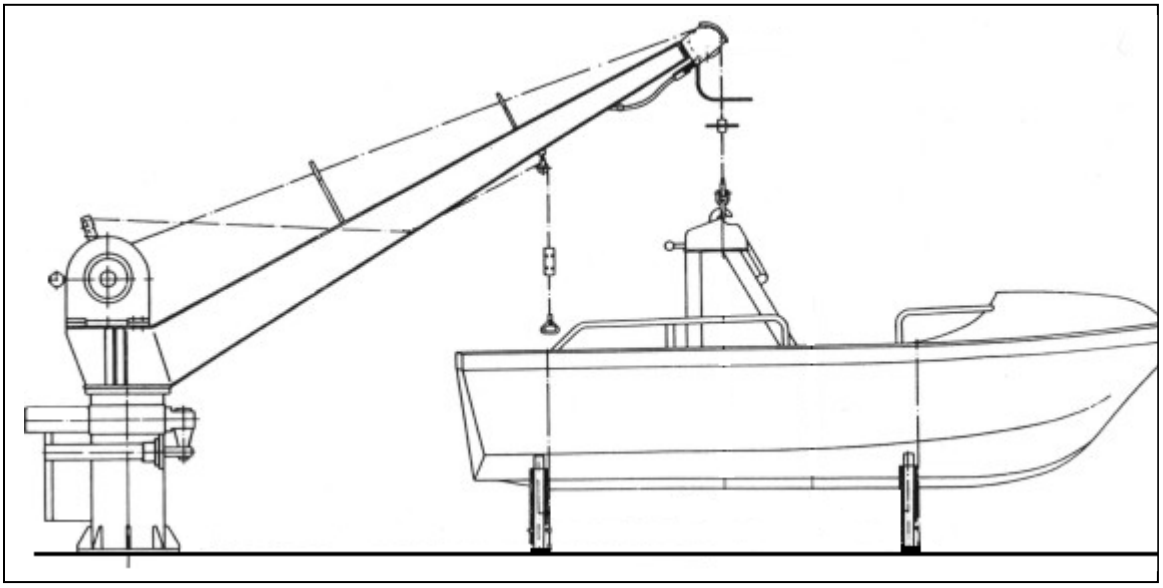


Fig. 5.10 The rescue boat launching davit simple scheme

5.4 Free-fall

It should be demonstrated that the free-fall release mechanism can operate effectively when loaded with a force equal to at least 200% of the normal load caused by the fully equipped lifeboat when loaded with the number of persons for which is to be approved.

5.5 Float – free arrangements

5.5.1 Float free arrangements

Float free arrangements shall provide for a liferaft to be released automatically in the event of a vessel's sinking.

5.5.2 Painter system

The liferaft painter system shall provide a connection between the ship and the liferaft and shall be so arranged as to ensure that the liferaft when released and in the case of an inflatable liferaft, inflated, it is not dragged under by the sinking vessel.

5.5.3 Hydrostatic Release Unit

a) Construction

A hydrostatic release unit used in float-free arrangements shall be so constructed that:

1.The materials used are compatible so as to prevent malfunction of the unit; galvanizing or other forms of metallic coating on parts of the release unit will not be accepted;

2.It has drains to prevent the accumulation of water in the hydrostatic chamber when the unit is in its normal position;

3. Each part connected to the painter system has a strength not less than that required by the painter;

4. It can readily be removed for replacement or annual servicing.

b) Materials and Components

Materials and components shall be corrosion-resistant and not affected by seawater, oil or detergents.

c) Performance

A hydrostatic release unit shall:

1. Function properly throughout an air temperature range of -30˚C to +65˚C;
2. Function properly throughout a seawater temperature range of -1˚C to +30 ˚C;
3. Automatically release the liferaft at a depth of not more than 4 metres;
4. Not release prematurely when seas wash over the unit;
5. Be capable of releasing a liferaft when the stowage is:
   - horizontal
   - tilted 45˚ and 100˚ with the hydrostatic release unit at the upper side;
   - tilted 45˚ and 100˚ with the hydrostatic release unit at the lower side;
   - vertical.

d) Marking

A hydrostatic release unit shall be marked permanently on its exterior with a means of identifying its type, serial number, depth at which it will release, and in addition if of a type which:

1) Requires annual servicing with its date of manufacture and a small plate permanently attached to the unit for recording the date of servicing;
2) Is disposable, with the date at which it must be replaced.

Markings must be done solely by a manufacturer or an authorised service station. The expiry date is 2 years from month of installation onboard. The release unit is labelled with a marking for year and month. Use a knife and carefully scratch away the appropriate square for month and year of expiry two years ahead. A hydrostatic release unit, which is not properly marked with its date of expiry, is not approved.

e) Instructions and Information

Instructions and information shall be provided in English in a clear and concise form and shall include the following:

1) General description of the unit;
2) Installation instructions;
3) Any on board maintenance requirements;
4) Servicing requirement

5.5.4 Weak link

a) Construction and Materials

A weak link used in the float free arrangements shall:

1) Be made from a material which is corrosion resistant and not affected by seawater, oil or detergent;

2) When made of cordage have the ends either whipped or heat treated;

3) When made from a flexible wire have each end looped around a thimble and secured with a locking ferrule.

b) Performance

A weak link shall be of sufficient strength to—

1) pull the painter out of the liferaft container;

2) operate the liferaft inflation system;

3) break under a tensile force of between 1.8 and 2.6 kN.

5.5.5 Different types of hydrostatic release unit

1. H.R.U. type " Hammar 20"

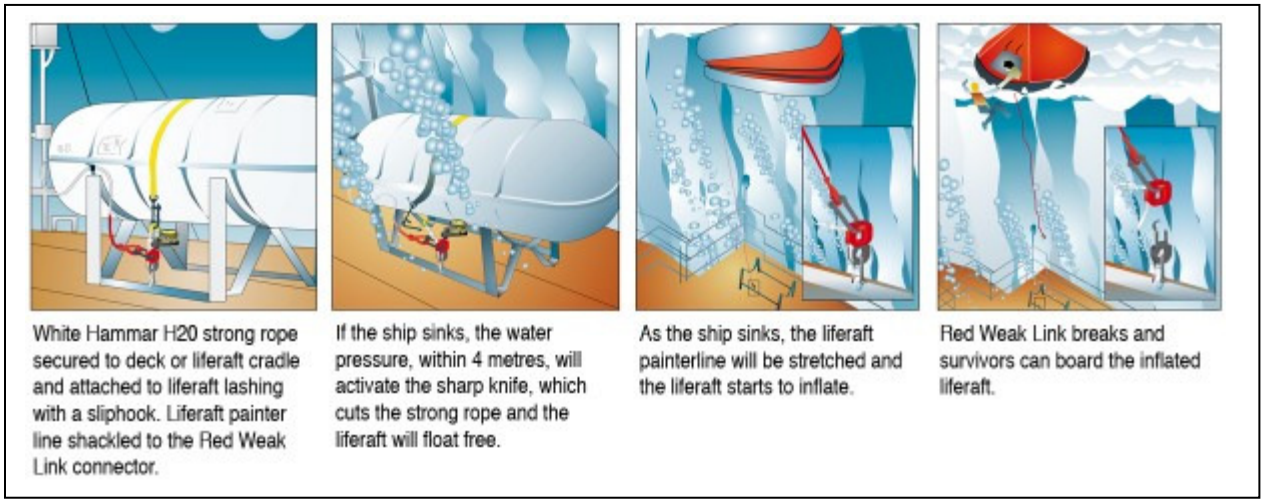

White Hammar H20 strong rope secured to deck or liferaft cradle and attached to liferaft lashing with a sliphook. Liferaft painter line shackled to the Red Weak Link connector.
If the ship sinks, the water pressure, within 4 metres, will activate the sharp knife, which cuts the strong rope and the liferaft will float free.
As the ship sinks, the liferaft painterline will be stretched and the liferaft starts to inflate.
Red Weak Link breaks and survivors can board the inflated liferaft.
1
2
3
4

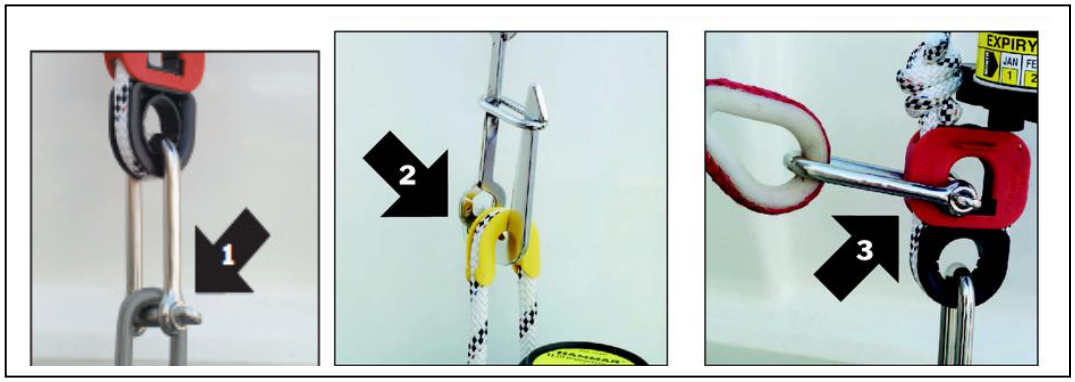
Fig. 5.11 Automatic release of liferaft

The Hammar 20 hydrostatic release unit is designed for liferafts from 6 to 20 persons. The unit consist of a double looped white rope line, a release mechanism and a Red Weak Link breaking strength 2.2 ± 0.4 kN.

The strong white rope is secured to the deck or liferaft cradle and attached to the liferaft lashing with a sliphook. If the ship sinks, the water pressure will (within 4 metres) activate the sharp knife which cuts the white rope and the liferaft will float free. As the ship sinks, the liferaft painter line will be stretched and the liferaft starts to inflate. The Red Weak Link breaks and survivors can board the floating liferaft.

The unit is made of glassfibre reinforced nylon, which means it won't rust. The HRU H20 needs no annual service maintenance or spare parts, however it

must be replaced after 2 years. HRU H20 must be marked with its expiry date in order to be approved. Each has its own individual serial number.



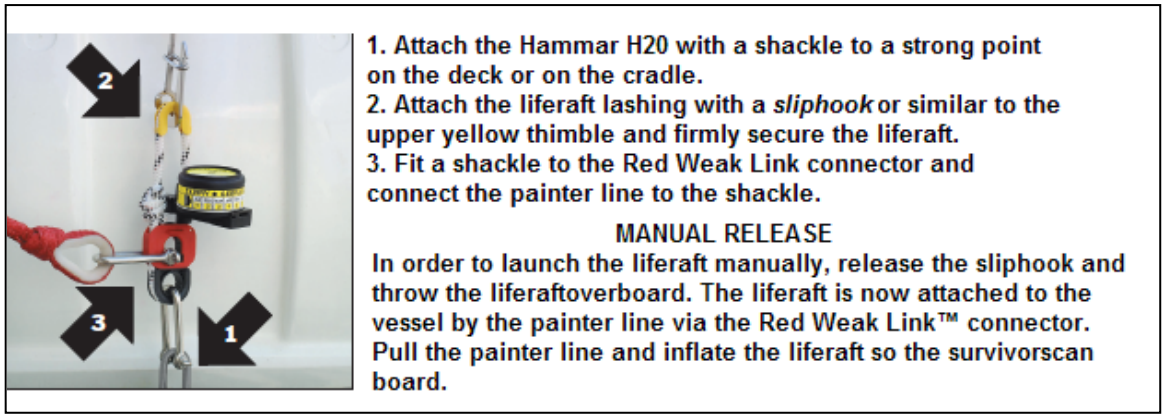

2
3
1
1. Attach the Hammar H20 with a shackle to a strong point on the deck or on the cradle.
2. Attach the liferaft lashing with a *sliphook* or similar to the upper yellow thimble and firmly secure the liferaft.
3. Fit a shackle to the Red Weak Link connector and connect the painter line to the shackle.
MANUAL RELEASE
In order to launch the liferaft manually, release the sliphook and throw the liferaftoverboard. The liferaft is now attached to the vessel by the painter line via the Red Weak Link™ connector. Pull the painter line and inflate the liferaft so the survivorscan board.

Fig. 5.12 Instalation of H.R.U. "Hammar 20 "

Fig. 5.13 Hydrostatic release unit " Hammar 20 "

CORRECT INSTALLATION OF HYDROSTATIC RELEASE UNIT

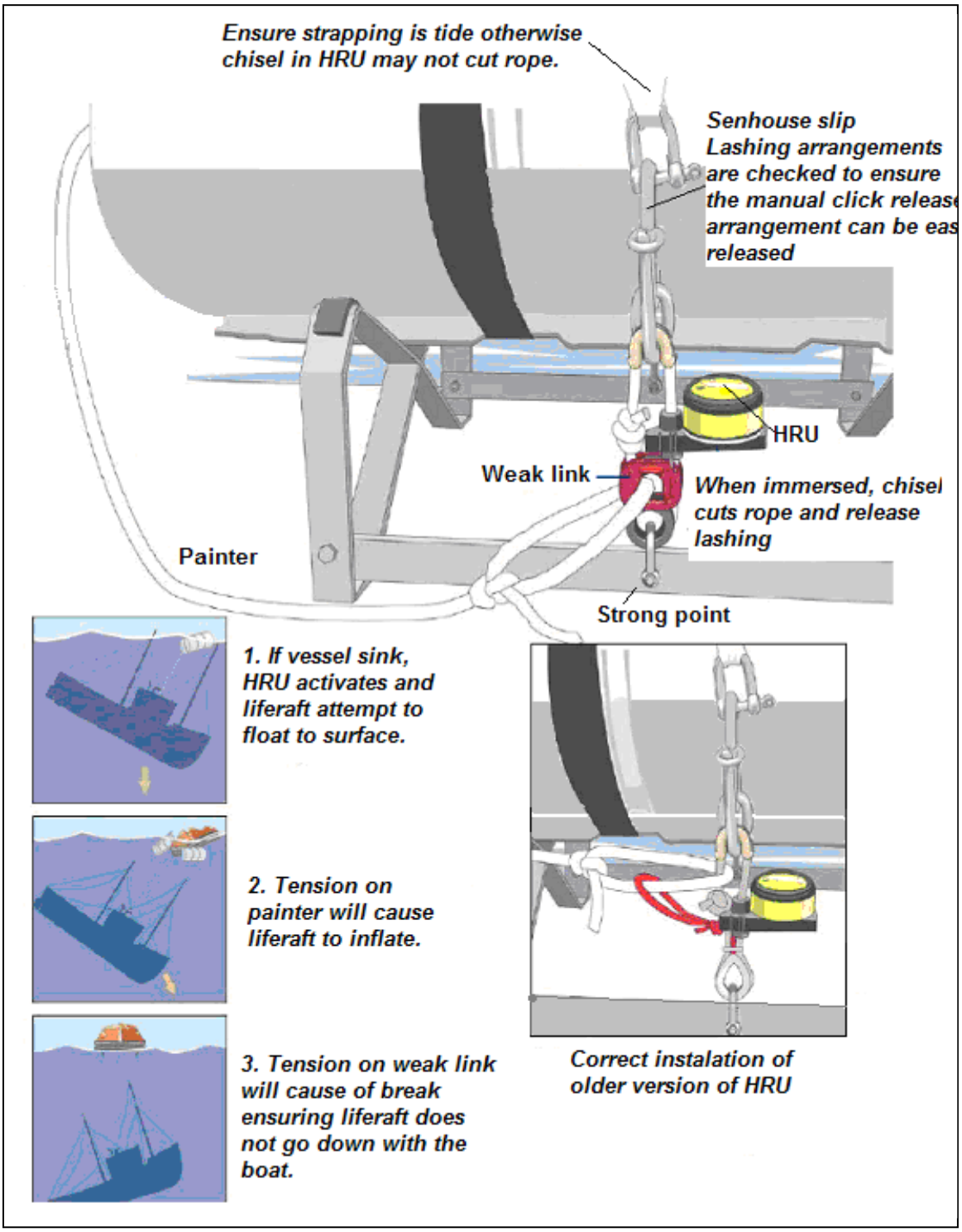

Ensure strapping is tide otherwise chisel in HRU may not cut rope.
Senhouse slip
Lashing arrangements are checked to ensure the manual click release arrangement can be eas released
HRU
Weak link
When immersed, chisel cuts rope and release lashing
Painter
Strong point
1. If vessel sink, HRU activates and liferaft attempt to float to surface.
2. Tension on painter will cause liferaft to inflate.
3. Tension on weak link will cause of break ensuring liferaft does not go down with the boat.
Correct instalation of older version of HRU

Fig. 5.14 Correct installation of H.R.U.

2. H.R.U. type "SALCOM SERVO-RELEASE

Manufactured by SalcomMarine Products Ltd, the SALCOM SERVO-RELEASE™ S-R Mk1 Hydrostatic Release Unit (H.R.U.) is designed for Liferafts from 4 to 150 persons and to sustain a maximum load of 10kN(2250lbs).

The "SALCOM SERVO-RELEAS" H.R.U. is a mechanical device that will operate automatically when immersed to a certain depth in water, to release a liferaft, or any other device requiring liberation under these conditions.

The HRU is installed as part of the liferaft stowage lashing system, (on the inboard side of the liferaft), being fitted between a deck plate, or liferaft cradle, and the lashing.

The fitting of *Senhouse Slip Hook is NOT necessary* as the SALCOM HRU is equipped with a MANUAL RELEASE facility.

Note: failure to adhere to the correct installation procedure may restrict the H.R.U. from releasing.

The liferaft painter is secured to a WEAK LINK (breaking strength 2.2 +/- 0.4 kN)and this in turn is fitted at the deck attachment of the HRU.

Liferafts that have not been launched in the usual manner are taken down with the sinking vessel. At a depth of between 1.5 to 4 meters (or 5 to 12 feet), the water pressure is sufficient to depress an internal diaphragm in the HRU and operate the release mechanism.

Once released, the liferaft container will then float free of the sinking vessel and rise towards the surface, with the painter line paying out as the vessel continues to sink.

When all the free length of the painter line is paid out, the inflation mechanism of the liferaft is activated, the liferaft inflates, bursting open the container, and continues to rise to the surface.

At this point of inflation, the WEAK LINK parts and allows the liferaft to continue to float to the surface ready for boarding by survivors.

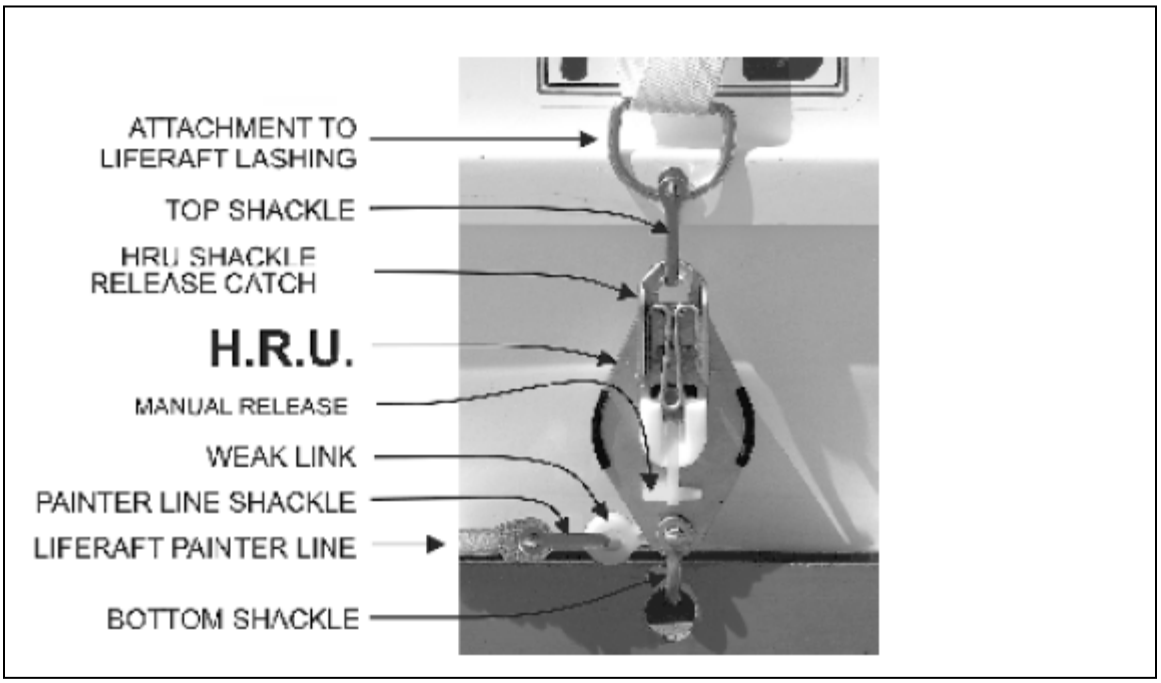


Fig. 5.15 Installation of HRU

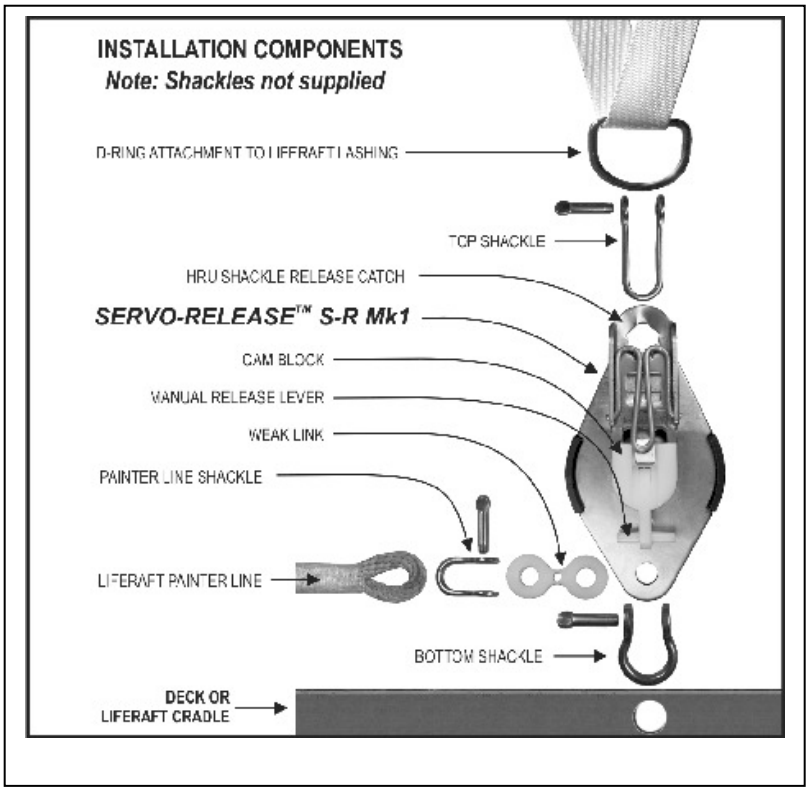


Fig. 5-16 Installation components

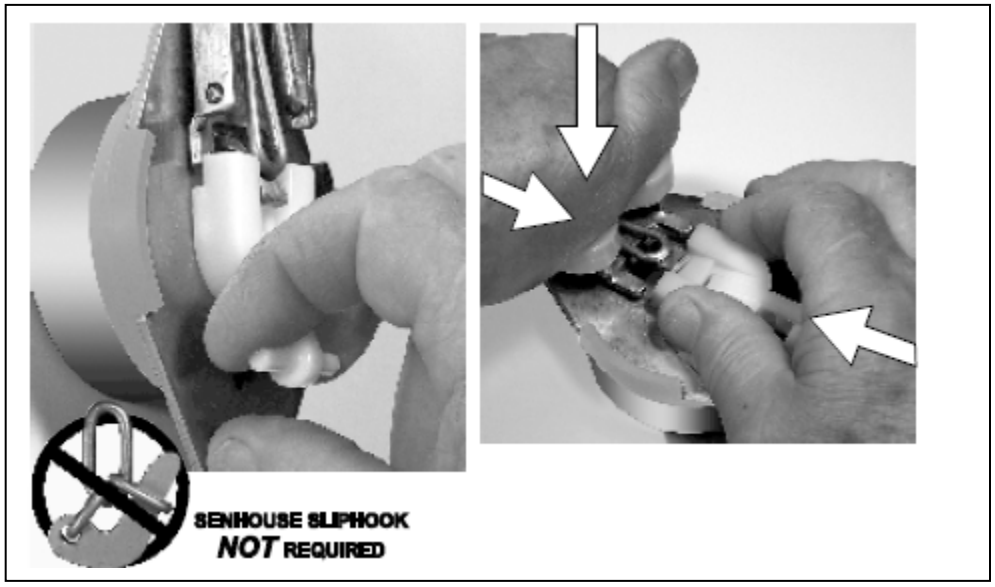


Fig. 5-17 Manual release and reassembling the manual release

Manual release: The H.R.U. has a manual release facility eliminating the requirement for a Senhouse Slip Hook. For annual liferaft service the SALCOM SERVORELEASE catch can be detached by lifting the release lever as illustrated in the adjacent picture.
Pull the release lever UP AND OUT.

Reassembling the manual release: Using the weak link placed over the release catch assembly, press the assembly down and slide the cam block towards the centre of the Hydrostatic Release Unit as show.
When sufficient downwards force is applied it will be possible to slide the cam block/release lever assembly between the Cam Tongue and the Shackle Release Catch tongues until it snaps into place. (Use the weak link as a tool to protect the hand from protrusions and distribute the
load while applying force.

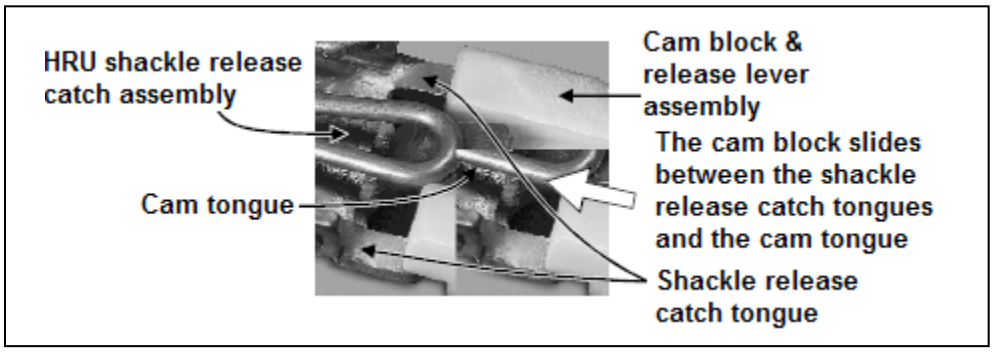

HRU shackle release catch assembly
Cam block & release lever assembly
The cam block slides between the shackle release catch tongues and the cam tongue
Cam tongue
Shackle release catch tongue

Fig-18 Manual release and maintenance of HRU

3. H.R.U Type " HKY -1 "

Hydrostatic release unit is a quick release device for inflatable liferafts. In case of ship sinks, it will automatically release the liferaft within 2-4 metres of water pressure.

Easy-breaking rope (under appropriate pressure).

Rope features include having a breaking strength of 2.2 ± 0.4KN and a 4mm diameter.

Material : Stainless steel

5.5.6 Maintenance of hydrostatic release unit

a. All hydrostatic release units should be inspected for correct installation and, if in doubt, correct installation information should be obtained from the unit's manufacturer.
b. All hydrostatic release units should be serviced annually, concurrent with the Inflatable Life Raft Service.
c. A record of the hydrostatic release unit's service should be kept on board the ship.
d. An operation and instruction manual should be kept on board the ship and all mariners should make themselves familiar with the hydrostatic release unit's function.
e. Each hydrostatic release unit, other than a disposable unit, must be serviced: within 12 months of its manufacture and within 12 months of each subsequent servicing, except when servicing is delayed until the next scheduled inspection of the vessel, provided that the delay does not exceed 5 months;

5.6 Marine evacuation systems

5.6.1 Construction of marine evacuation system

(Life Saving Appliances Code Chapter VI, 6.2.1)

The passage of the marine evacuation system shall provide for safe descent of persons of various ages, sizes and physical capabilities, wearing approved lifejackets from the embarkation station to the floating platform or survival craft.

Strength and construction of the passage and platform shall be to the satisfaction of the Administration.

The platform, if fitted, shall be:

- such that sufficient buoyancy will be provided for the working load. In the case of an inflatable platform the main buoyancy chambers, which for this purpose shall include any thwarts or floor inflatable structural members, are to meet the requirements of section 4 .2 based upon the platform capacity, except that the capacity shall be obtained by dividing by 0.25 the usable area given in paragraph 6 .2.1. 3.3;
- stable in a seaway and shall provide a safe working area for the system operators;
- of sufficient area that will provide for the securing of at least two liferafts for boarding and to accommodate at least the number of persons that at any time are expected to be on the platform.

This usable platform area shall be at least equal to:

$$\frac{\text{20\% of total number of persons that the marine evacuation system is certified for}}{4} \ (m^2)$$

or 10 m², whichever is the greater. However, Administrations may approve alternate arrangements which are demonstrated to comply with all of the prescribed performance requirements;

- self-draining
- subdivided in such a way that the loss of gas from any one compartment will not restrict its operational use as a means of evacuation. The buoyancy tubes shall be subdivided or protected against damage occurring from contact with the ship's side;
- fitted with a stabilizing system to the satisfaction of the Administration;
- restrained by a bowsing line or other positioning systems which are designed to deploy automatically and, if necessary, to be capable of being adjusted to the position required for evacuation; and
- provided with mooring and bowsing line patches of sufficient strength to securely attach the largest inflatable liferaft associated with the system.

If the passage gives direct access to the survival craft, it should be provided with a quick-release arrangement.

5.6.2 Performance of marine evacuation system
(Life Saving Appliances Code Chapter VI, 6.2.2)

A marine evacuation system shall be:

- capable of deployment by one person;
- such as to enable the total number of persons for which it is designed, to be transferred from the ship into the inflated liferafts within a period of 30 min in the case of a passenger ship and of 10 min in the case of a cargo ship from the time the abandon ship signal is given;
- arranged such that liferafts may be securely attached to the platform and released from the platform by a person either in the liferaft or on the platform;
- capable of being deployed from the ship under unfavourable conditions of trim of up to 10˚and list of up to 20˚either way;
- in the case of being fitted with an inclined slide, such that the angle of the slide to the horizontal is:
  - within a range of 30˚ to 35˚ when the ship is upright and in the lightest sea-going condition; and
  - in the case of a passenger ship, a maximum of 55˚ in the final stage of flooding set by the requirements
- evaluated for capacity by means of timed evacuation deployments conducted in harbour;
- capable of providing a satisfactory means of evacuation in a sea state associated with a wind of force 6 on the Beaufort scale;
- designed to, as far as practicable, remain effective under conditions of icing; and
- so constructed that only a minimum amount of routine maintenance is necessary. Any part requiring maintenance by the ship's crews shall be readily accessible and easily maintained.

Where one or more marine evacuation systems are provide on a ship, at least 50% of such systems shall be subjected to a trial deployment after installation. Subject to these deployments being satisfactory, the untried systems are to be deployed within 12 months of installation.

5.6.3 Marking on marine evacuation systems

The marine evacuation system shall be marked with:

- maker's name or trade mark;
- serial number;
- date of manufacture (month and year);
- name of approving authority;
- name and place of servicing station where it was last serviced, along with the date of servicing; and
- the capacity of the system.

5.6.4 Containers for marine evacuation systems

The evacuation passage and platform shall be packed in a container that is:

- so constructed as to withstand hard wear under conditions encountered at sea; and
- as far as practicable watertight, except for drain holes in the container bottom.

The container shall be marked with:

- maker's name or trade mark;
- serial number;
- name of approval authority and the capacity of the system;
- SOLAS;
- name of approval authority and the capacity of the system;
- date of manufacture (month and year);
- maximum permitted height of stowage above waterline; and
- stowage position on board.

Launching and operating instructions shall be marked on or in the vicinity of the container.

5.6.5 Inflatable liferafts associated with marine evacuation systems

Any inflatable liferaft used in conjunction with the marine evacuation system shall:

- conform with the requirementso f section4 .2;
- be sited close to the system container but be capable of dropping clear of the deployed system and boarding platform;
- be capable of release one at a time from its stowage rack with arrangements which will enable it to be moored alongside the platform;
- be stowed in accordancew ith regulationl ll/.13 .4; and
- be provided with pre-connected or easily connected retrieving lines to the platform.

5.6.6 Stowage of marine evacuation systems

(SOLAS,Chapter III, Regulation 15)

The ship's side shall not have any openings between the embarkation station of the marine evacuation system and the waterline in the lightest seagoing condition and means shall be provided to protect the system from any projections.

Marine evacuation systems shall be in such positions as to ensure safe launching laving particular regard to clearance from the propeller and steeply overhanging positions of the hull and so that, as far as practicable, the system can be launched down the straight side of the ship.

Each marine evacuation system shall be stowed so that neither the passage nor platform nor its stowage or operational arrangements will interfere with the operation of any other life-saving appliance at any other launching station.

Where appropriate, the ship shall be so arranged that the marine evacuation systems in their stowed positions are protected from damage by heavy seas.

5.6.7 Servicing of marine evacuation systems

(SOLAS,Chapter III, Regulation 20)

Every inflatable liferaft, inflatable lifejacket, and marine evacuation system shall be serviced:

- at intervals not exceeding 12 months, provided where in any case this is impracticable, the Administration may extend this period to 17 months; and
- at an approved servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.

In addition to or in conjunction with the servicing intervals of marine evacuation systems, each marine evacuation system should be deployed from the ship on a rotational basis at intervals to be agreed by the Administration provided that each system is to be deployed at least once every six years.

5.6.8 Different types of marine evacuation system

1. The Zodiac/DBC Marine Evacuation Chute (MEC) System

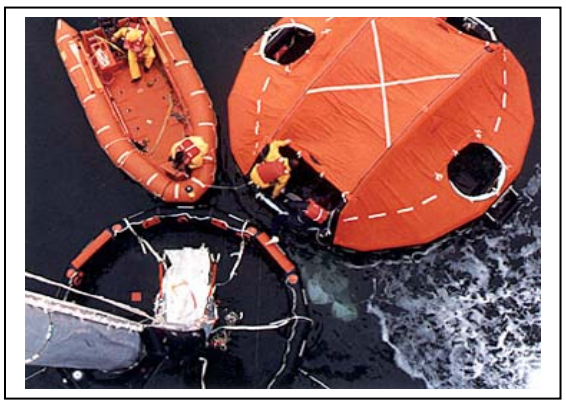


Fig.5.19 Marine Evacuation Chute

A fabric descent chute and inflatable platform are stored in a compact housing either on the evacuation deck (inside or outside the vessel) or unobtrusively on the deck above.

During an emergency, a crew-member releases the MEC with a pull of a handle. The chute and platform fall to the water and the platform automatically inflates.

At the same time, the liferafts are launched from their racking system, inflated and attached to the platform.

Passengers enter the chute by way of the housing and safely descend to the platform.

Fig.5.22 MEC on deck

Zodiac/DBC's MEC System takes up very little space on deck. The chute housing is compact, and the liferafts are tidily stored on rack out of the way of passenger or crew traffic.

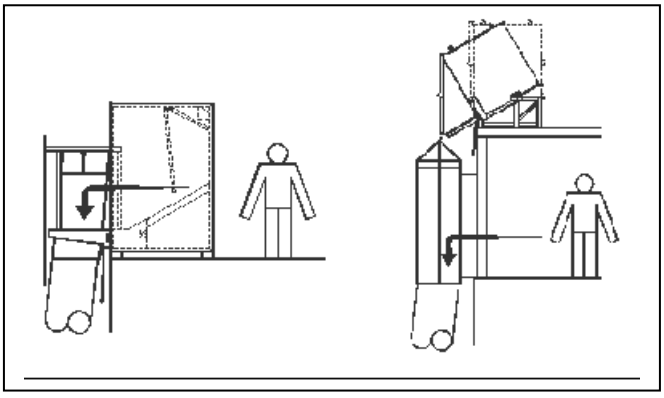


Fig. 5.23 Internal or External type housing

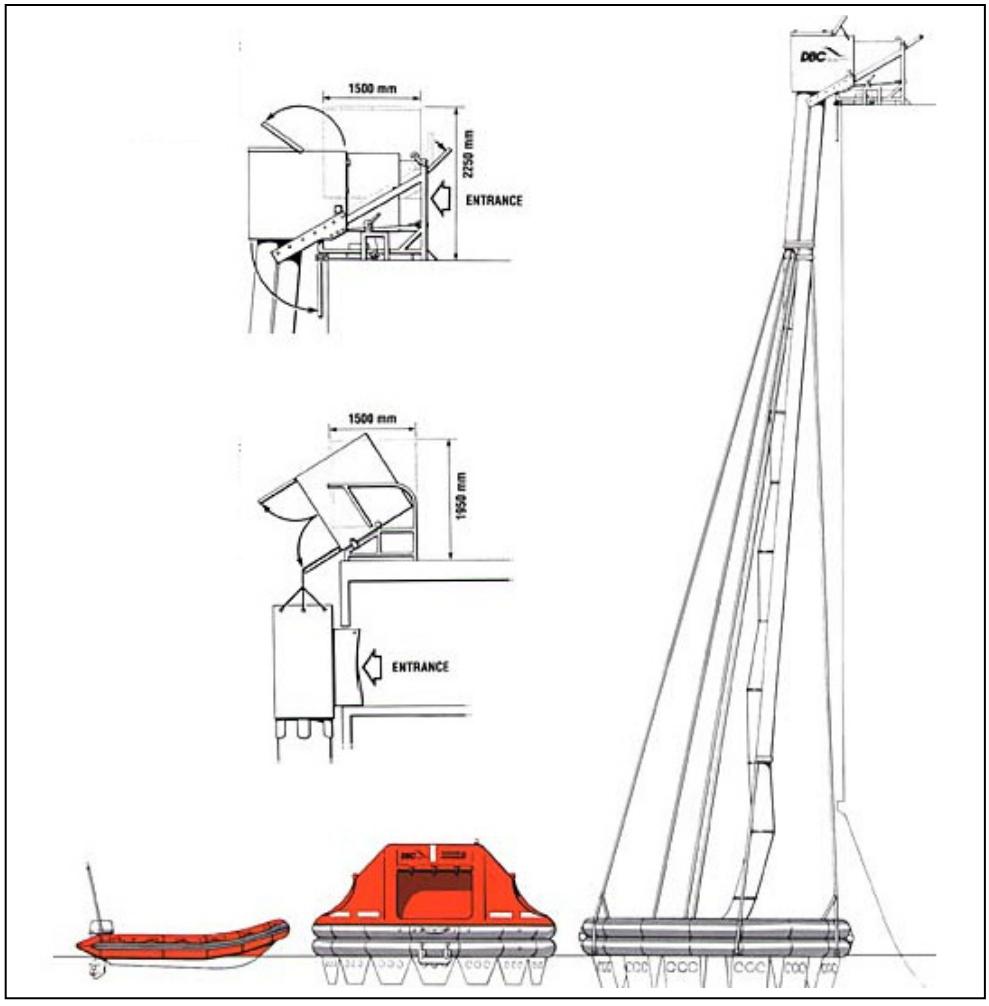


Fig. 5.24 Marine Evacuation Chute (MEC) System

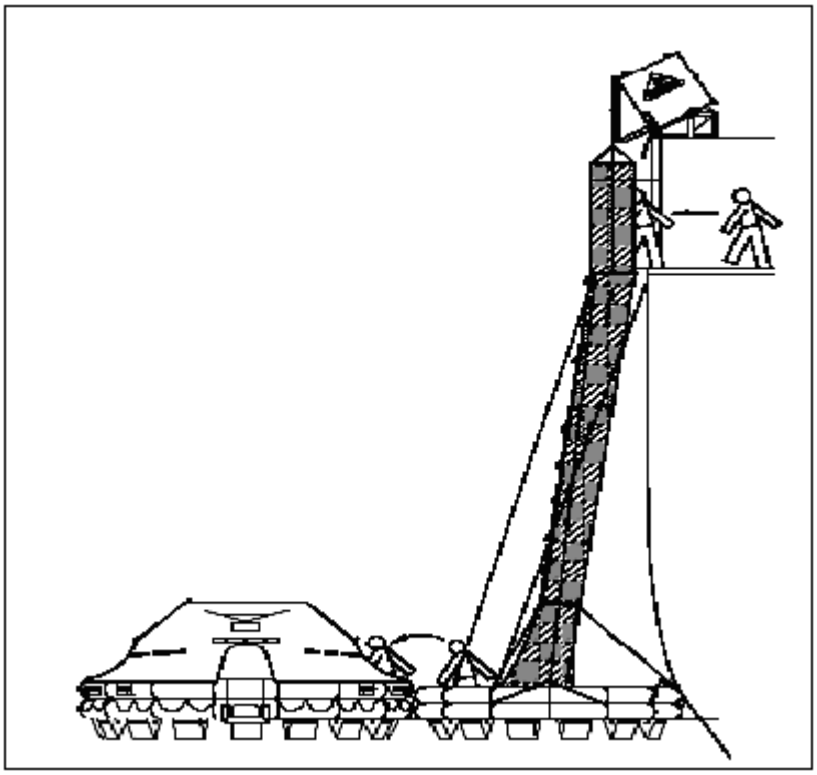


Fig.5-25 MEC with inflated platform and liferaft. MEC housing installed above evacuation deck

2. DSB Marine Evacuation System

Fig. 5.26 The DSB & Brude Slide evacuation system

Fig.5-27 CAT - Slide System

The CAT-Slide System is suitable for either self-righting and open reversible liferaft arrangements up to 150 persons.

3. Viking marine evacuation system

The reinforced Kevlar evacuation chute provides a safe descent path and compensates for ship and sea movement so that evacuation is not obstructed.

This system has the additional advantage of protecting evacuees from environmental hazards, such as severe weather conditions, during evacuation and is fitted with a protective cover.

The system is self-contained and compact, which means that it can be installed anywhere onboard on open deck, between decks in an open recess, or built into the ship's side.

Fig.5.28 Evacuation chute

Fig. 5.29 Evacuation slide

The dual track slide consist of 12 main tubes with 8 separate compartments that are individually inflated. This means that the slide's stability is not compromised in the unlikely event that slide becomes punctured in any one place.

The angle between the slide and the ship ensures that the system can absorb the movement between ship and even high seas. The 30˚ angle of the slide also means that the evacuation slide system can be installed at extreme forward and aft position. Capacity is easily adapted to suit the particular needs of any vessel by combining any 25 to 101 person liferafts.

6 . Evacuation and recovery of survival craft and rescue boats

6.1 Launching

6.1.1 Gravity davits

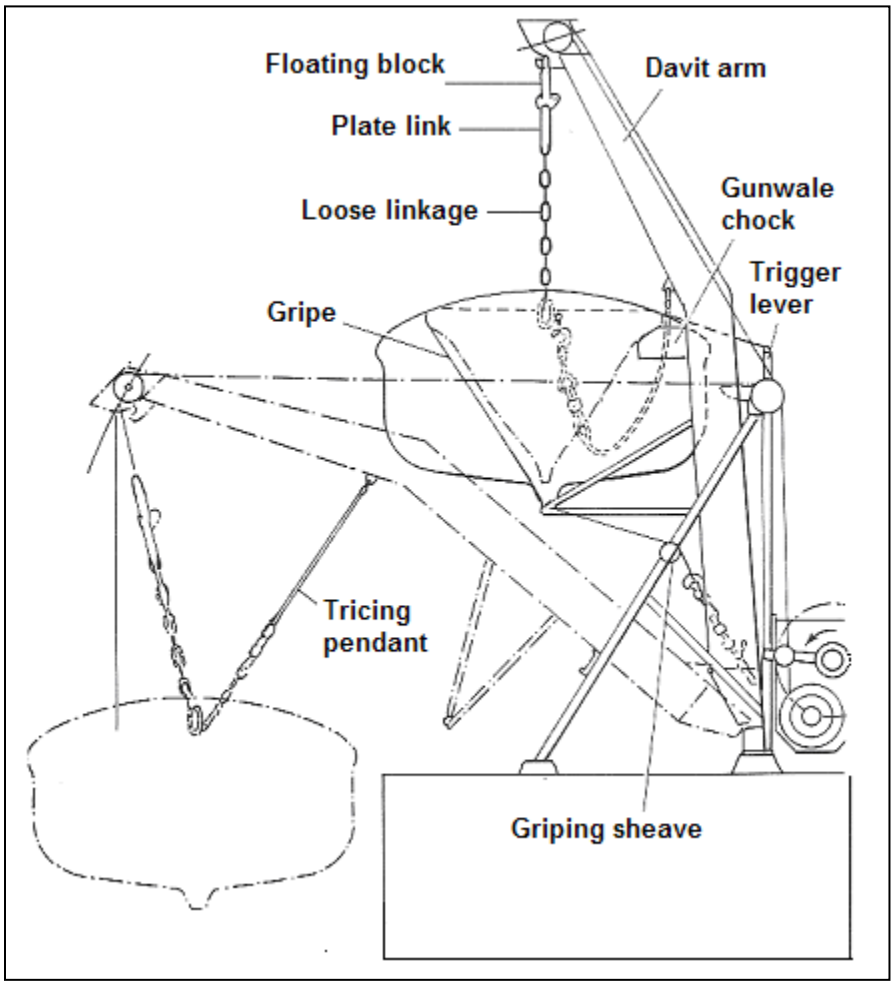


Fig. 6.1 Gravity davit scheme

These davits operate on the principle of the boat's own weight doing the work to bring about the launching. The construction of the davits includes a safety device, usually a trigger arrangements attached to the gripes.

The launching procedure is as follows :

1. Two men should be ordered into the boats to ship the plug and check that the painter is rigged and secure in a correct manner. (Toggle painter,

passed inside the fall and outside everything else, and secured well forward). The two men should then clear the boat.

2. The coxswain should order the harbour pins removed if these have not already cleared.
3. The gripes should be slipped and any trigger arrangement checked to see that it is clear, the gripes being cleared away from the davits.
4. A winchman must be stood by, to lower the boat down to the embarkation deck.
5. Check that the overside is clear, then lower away by lifting the “brake handle”.

The boat should be allowed to descend from the davit until the tricing pendants take the boat’s weight and draw the boat into the ship’s side.

6. Two men should enter the boat at the embarkation deck and pass the bowsing-in tackles. These two tackles should be rigged in such a manner as to have the downhaul secured in the boat, by a round turn and two half hitches, on the bight, around the linkage at the end of the falls.
7. The coxswain should order the tricing pendants to be slipped when he is satisfied that the bowsing-in tackles are secured and the men in the boat are holding lifelines.
8. All passengers and remaining crew members should embark and seat themselves in the boat, as low as possible.
9. Ease out the bowsing-in tackles and allow the boat to move off the ship’s side, to hang vertically from the davit heads.
10. Final check overside, and order the winchman to lower away with a run.

If practicable the boat should be released from the falls when on the crest of a wave. As the wave drops away from the ship’s side so it takes the boat clear and into the trough.

During the preparation and launching operation, the survival craft, the launching appliance and the water area to which the craft is being launched shall be adequately illuminated by lighting supplied from the emergency source of electrical power. Preparation and handling of survival craft at one launch station shall not interfere with the handling of any other survival craft or rescue boat.

6.1.2 Launching the inflatable liferaft

The web straps securing the raft in tis stowage cradle should be released by slipping the manually operated senhouse slip positioned above the float-free arrangement. The liferaft container should then be manhandled to the launching position at the ship’s side. If ship’s guard rails are in position, these should be removed to facilitate an easier launching.

The painter line from the liferaft should be secured to a strong point aboard the vessel. Where a hydrostatic release unit is featured, the painter and the “D” ring should be inspected to ensure that they are well fast.

Pull out a limited amount of the painter line from the container, and check that water surface is clear of other survivors or debrits. Throw the liferaft in its container, over the side into clear water.

Throw the liferaft in its container, over the side into clear water. Inflation will be caused by a sharp “tug” on the painter once it is fully extended. The action of pulling sharply on the painter line will cause the CO_2 gas bottle to be fired, so inflating the liferaft.

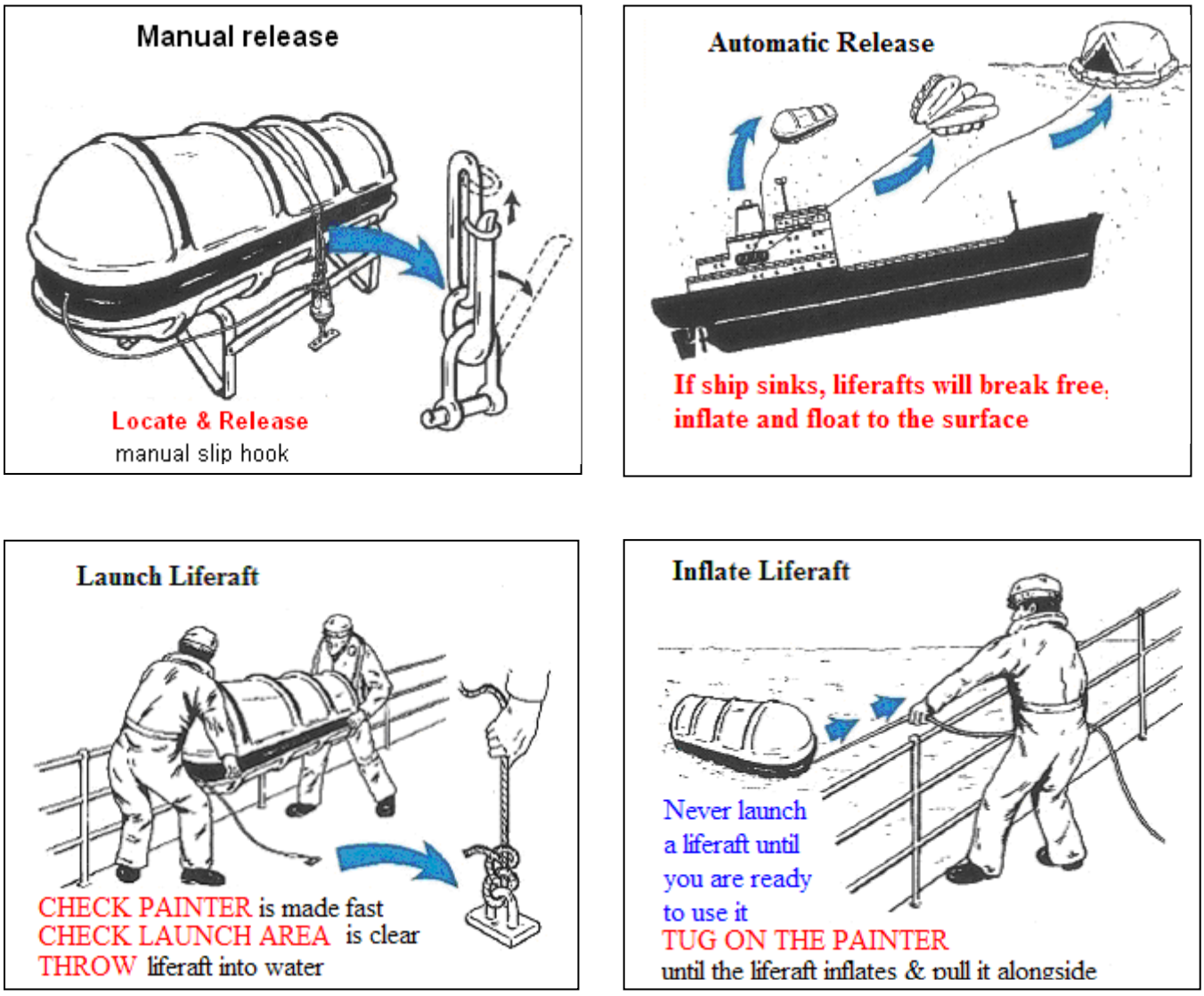
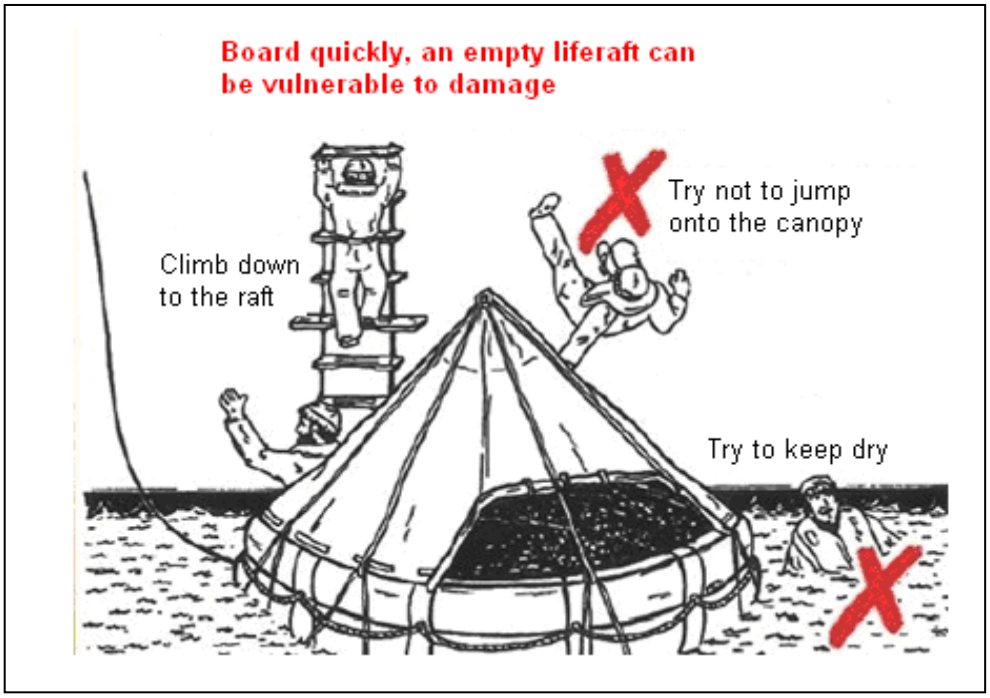
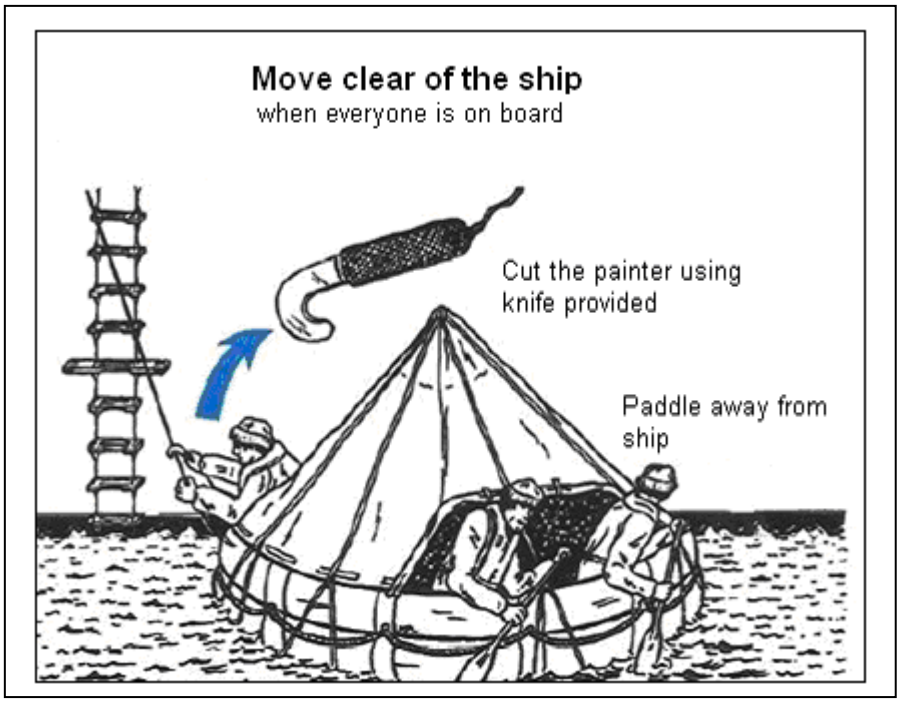
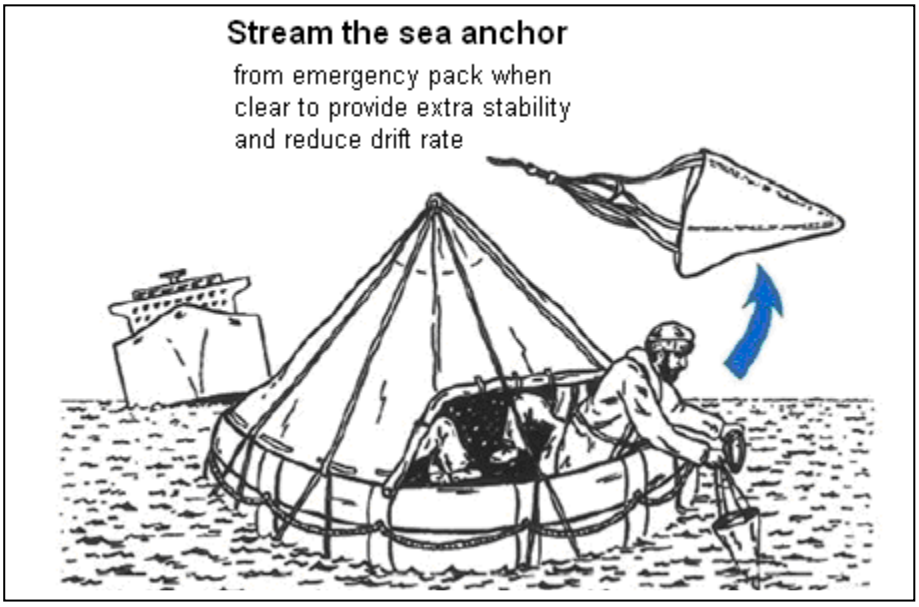

Manual release
Locate & Release
manual slip hook
Automatic Release
If ship sinks, liferafts will break free, inflate and float to the surface
Launch Liferaft
CHECK PAINTER is made fast
CHECK LAUNCH AREA is clear
THROW liferaft into water
Inflate Liferaft
Never launch a liferaft until you are ready to use it
TUG ON THE PAINTER
until the liferaft inflates & pull it alongside

Fig. 6.2 Manual and automatic release of lifeboat


Board quickly, an empty liferaft can be vulnerable to damage
Climb down to the raft
Try not to jump onto the canopy
Try to keep dry


Move clear of the ship
when everyone is on board
Cut the painter using knife provided
Paddle away from ship



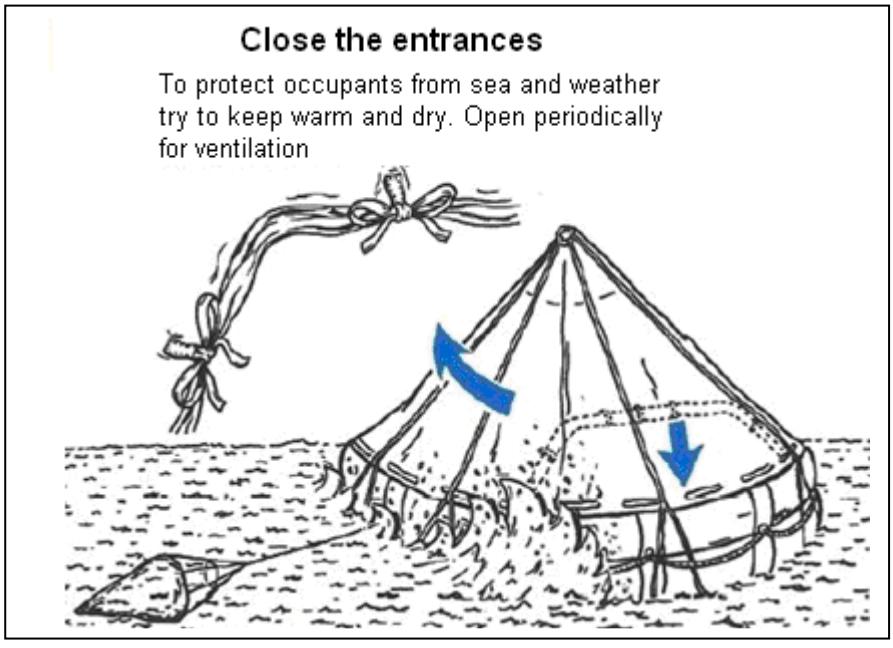

Close the entrances
To protect occupants from sea and weather try to keep warm and dry. Open periodically for ventilation

Fig. 6.3 Actions after boarding the liferaft

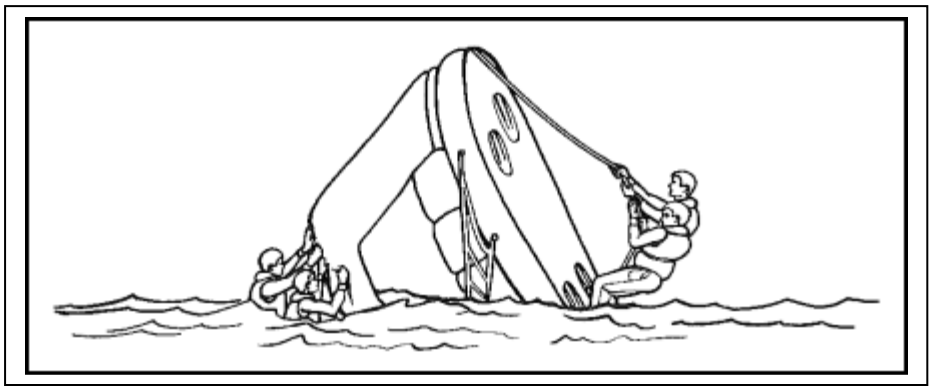


Fig. 6.4 Righting upturned liferaft

6.1.3 Launching of the davit-launching liferaft

The launching procedure for the davit-launched follows a general format; however of slight differences between manufacturers, some terms and operational detail may be recognized under alternative labels.

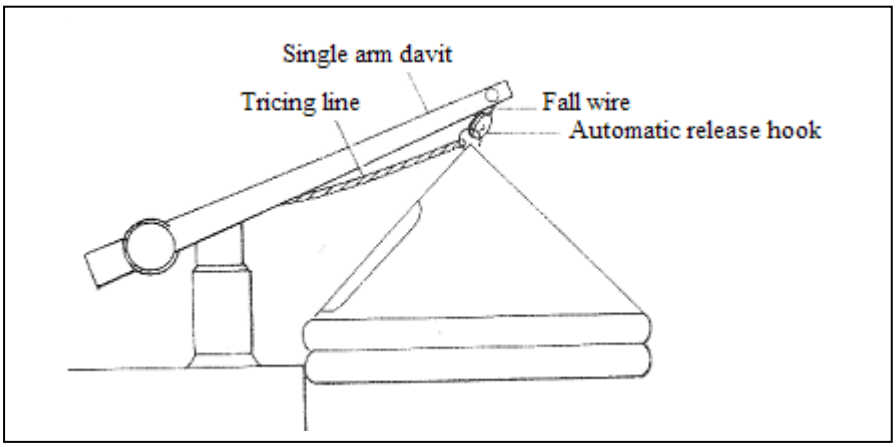
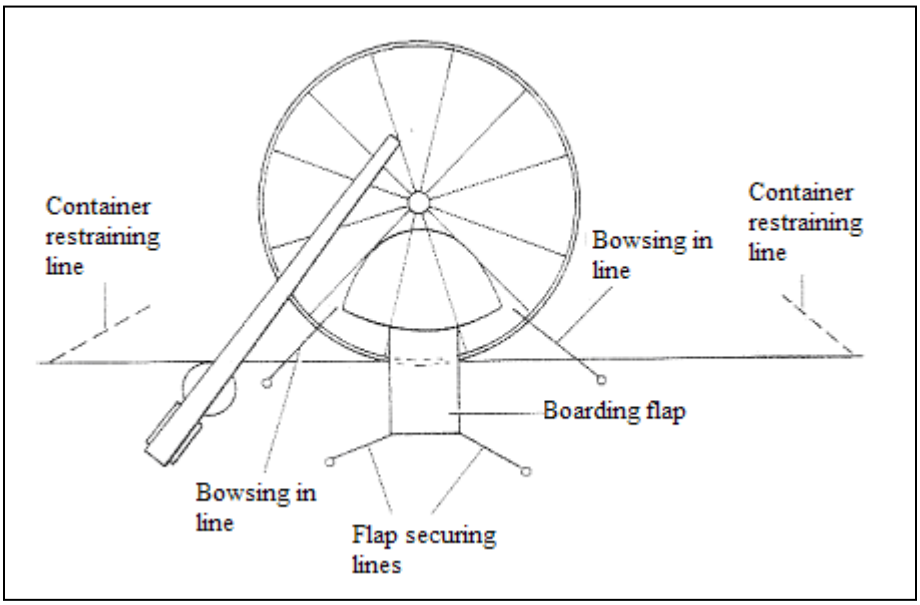


Fig. 6.5 Single arm davit scheme

Checks prior to boarding

- Ensure that no person is in possession of, or wearing, any sharp objects that may puncture or damage the liferaft.
- Ensure that the liferaft is well ventilated of excess of CO_2 gas before allowing persons to enter.
- When boarding, load the raft in a stable manner with persons on each side with their feet into the centre.



Launching procedure of the davit-launched liferaft

1. Manhandle the liferaft in its canister/valise to a position of launching, alongside the structure and under the davit head.
2. Remove any side protective rails and check that the overside and surface level are clear of obstructions and other survivors.
3. Lower the release hook to the liferaft. Close the hook and check that it is locked into “safe” position.
4. Extract the “container retaining lines” from the canister and secure them to the vessel structure, either side of the launching position.
5. Extract the bowsing lines and secure them to the deck cleats provided.
6. Extract a length of the long rope painter and secure it to a fixed anchor point on the vessel structure.
7. Pull out a short length of the webbing painter.
8. Hoist the liferaft towards the davit head and clear of the deck. Turn out the davit arm overside, to an appropriate angle to suit the size of liferaft being used.
9. Inflate the liferaft by pulling sharply on the full length of the webbing painter.
10. Tension up on the bowsing lines and secure the boarding flap.
11. Board personnel in an orderly manner observing all checks.
12. Once the liferaft is fully loaded, release the boarding flap, the bowsing lines and the short webbed painter and throw all parts into entrance of the raft.
13. Lower the liferaft to about 2 metres above and clear of the water surface.
14. The person in charge of the liferaft should at this point activate the release lock of the hook by pulling smartly on the knobbed cocking lanyard.
15. The liferaft is lowered to the surface and is automatically released from the hook .Cut the painter line and manoeuvre the raft away and clear.

6.1.4 Automatic release hook for davit-launching liferaft

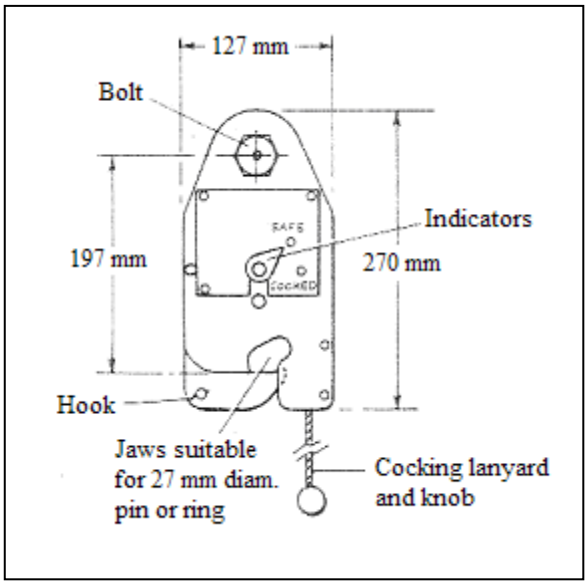


Fig. 6.6 Release hook

The automatic release hook is for use with liferafts or small boats where a quick simple and automatic disengagement of the craft from the lowering gear is required.The hook itself is a basically of the " fail safe" or off load release type, which means that it cannot be released whilst laden, but it has an automatic device which releases as soon as the craft is waterborne.

The "fail safe " characteristic is achieved by the geometry of the hook, which is so shaped that in order to release the craft before it is waterborne the entire weight of the craft would have to be lifted, this is due to the peculiar curve of the bill of the hook. As is no force to swivel the hook, it is clearly impossible to effect a release until the craft is settled on the water.

All the working parts are contained between the two side plates, which are permanently riveted together. The hook and latch rotate on shafts through the plates which are held in position by circlips visible on the outer surfaces of the side plates. The pawl is retained by the pawl pin which is retained by the instruction plates secured by screws to the side plates. As the latch and pawl are approximately half the thickness of the hook, the latch shaft and the pawl pin have spacers fitted each side of these components, holding them centrally between the side plates. Only the nut (not shown) and bolt may be removed when the tab washers are opened back. As the bolt is withdrawn, the two cones are released. When the hook is in the Safe Position it is locked closed by a step on the hook which bears against a corresponding step on the latch.

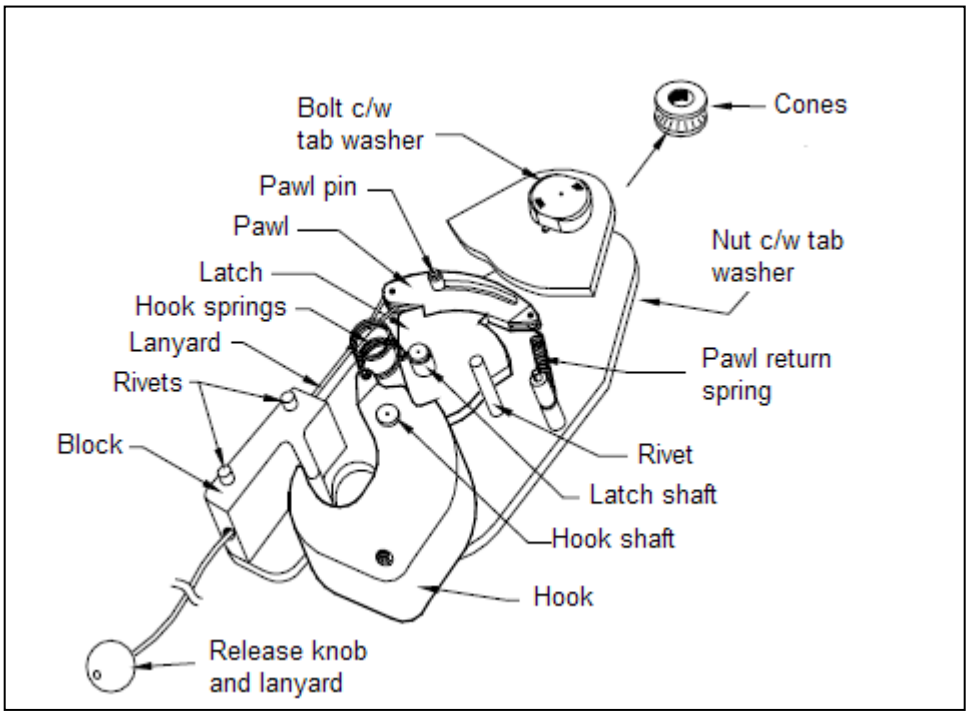


Fig. 6.10 The description of the automatic release hook Mk 5 from RFD

When the lanyard is pulled, the pawl travels along the slot through which is the pawl pin, allowing it to move away from the return spring when the lanyard is pulled, and to return when released. As the pawl moves so steps on the pawl and latch, which are in engagement, rotate the latch. This also moves the lower step on the latch out of engagement with that on the hook. The two large springs act to open the hook as its load is reduced. In case of non-opening, the lanyard must be pulled again, the second position latch rotating the latch still further and contacting part of the hook. This applies an opening force capable of releasing a load of up to 100 kg. on the fall.

Off load (normal) release

With the hook in the safe position, the hook cannot open. When the boat is approximately 2m. above the water, pull the lanyard. The weight of the boat will hold the hook closed. As the weight comes off the hook, it will open automatically.

Partial load (emergency) release

Should the hook fail to open, pull the lanyard strongly again. In this case the pawl engages in the second position on the latch, rotating it further when it applies an opening force on the upper part of the hook, which is capable of being forced open when the load on it is less than 100 kg.

Connection to the boat

Open the hook by pulling downwards on the release knob. Position the ring in the cut out near the block. Press the hook closed between the hands. This will return the pointer to the safe position and retain the ring which must not lie over the tongue extension on the block.

WARNING

Hook release under load in a boat whose lifting sling is under tension will cause the lifting ring to come off the hook with considerable violence. The boat and lifting sling store up energy and act like a spring as the hook is released. Boat crew must be made aware of this. Keep away from the ring and lifting sling.

Do not pull the lanyard until the boat is approximately 2 m. above the water.

Inspection and maintenance of 3.0 tonne Release Hook

Check the following visually :

- that the hook is securely attached to the loop at the end of the davit fall by ensuring that the swaged eye on the end of the fall is secured under the cones, and that the nut and bolt are secured by their tab washers.
- that there is no severe contamination. If so it should be washed off using a suitable solvent cleaner. Apply the approved grease with a small brush, working it well into the moving areas and parts of the mechanism. Do not use solidifying or emulsifying grease.
- that all four circlips are in position on the hook and latch shafts.

Test hook operation and condition as follows:

- pull the operating knob to ensure that the hook opens fully and freely, and that it can be reset easily and fully.
- check that the knob is secure on the end of the release cable.
- check that the cable is not frayed.
- hang a load of 9 kg. on the hook using a 25.4 mm dia. lifting ring. Operate the hook by pulling the lanyard. The hook must open and release the load.
- close the hook. Hang a load of 50 kg. on the hook. Pull the lanyard. The hook must not open. Release the lanyard completely, then pull the lanyard hard a second time. This time the pawl will engage the second latch position. The hook must open under lanyard action and release the load.
- check that the hook is secured to a suitable strong point nearby to prevent it swinging with the ship’s motion.

6.2 Clearing the ship's sides

The period of launching is potentially one of the most hazardous that the boat and its crew will pass through.

Once a surface is reached and the falls are about to be released (aft fall first) the floating blocks/linkage on the end of the fall becomes a real danger to personnel inside the boat. This danger is increased considerably if the sea conditions are "choppy" and if a swell is present, causing excessive, violent motion of the boat.

The bow of the boat should be retained by the temporary painter and the engine should be operational. The bowman should be employed constructively to bear away by means of the boathook, while the coxswain should move ahead and away by pushing the tiller towards the ship's side. Extreme care must be taken to ensure that persons are sitting low down in the boat to avoid contact with the floating blocks, once released.

As the boat clears the side, weight will be seen to come on to the painter and this should be slipped as soon as possible once sea room is obtained so that the manoeuvre will keep the propeller clear of the slipped painter.

It is always desirable that the mother ship should provide a " lee" when a boat is launched. However, there may be occasions when this is not possible. Neither must it be assumed that the parent vessel is always stopped; it could very well have limited " headway" when engaged on a launching operation.

6.2.1 Taking away a boat (open boat without power, parent vessel stopped)

On reaching the surface the lifeboat falls should be released. This is potentially one of the most dangerous times for the boat's crew, whohave their head height at the level of the fall blocks.

The outboard oars should be lowered while the inboard oars should remain in the " tossed" position. The bowman and the outboard oarsmen should stand by to bear off from the ship's side using the boathook and the looms of the oars respectively.

Heaving on the painter, down the inboard side, would accentuate the movement of the boat's bow outward and away from the vessel's side.

Once the bow is "arcing" away from the ship's side the widening space should permit the inboard oars to be lowered. Let the painter go as soon as practicable.

The inboard oarsmen should gibe way on their oars while the outboard oarsmen should hold water until that time when the boat's stem is away from the side.

Coxswain should give their orders sharply and clearly. It is equally important that oarsmen should respond in a smart effective number in order to clear the boat from the critical area of launching.

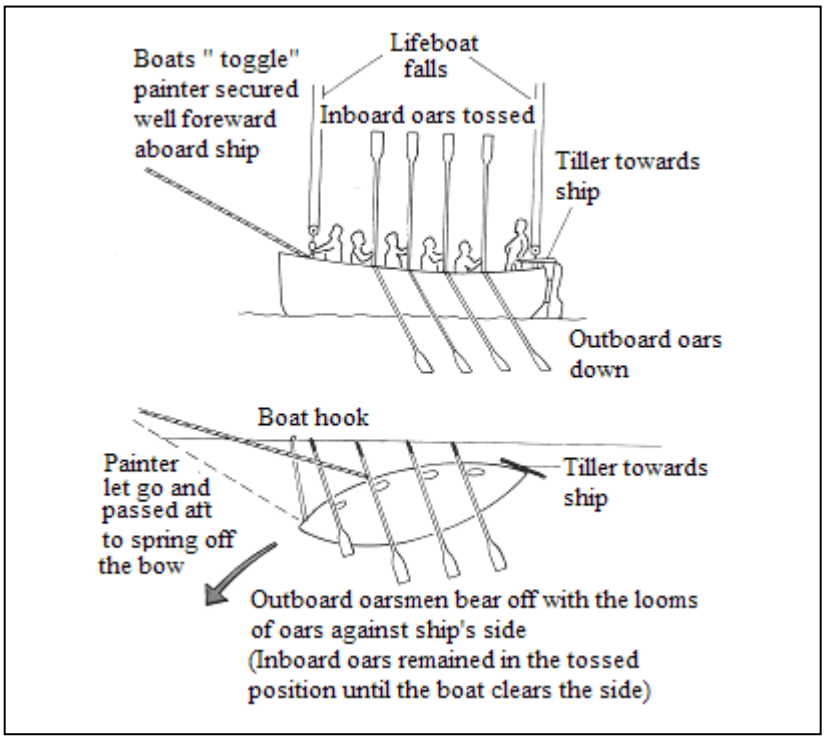

Boats " toggle" painter secured well foreward aboard ship
Lifeboat falls
Inboard oars tossed
Tiller towards ship
Outboard oars down
Boat hook
Painter let go and passed aft to spring off the bow
Tiller towards ship
Outboard oarsmen bear off with the looms of oars against ship's side
(Inboard oars remained in the tossed position until the boat clears the side)

Fig. 6.11 Lowering and taking away

6.2.2 Taking away a boat (parent vessel underway and making way)

In many cases this method can prove easier than the method used where the vessel is stopped in the water. The parent vessel provides the motive power, which should be under 4 knots.

On reaching the surface the lifeboats falls should be released.

Once these are seen to clear the full weight of the boat will be seen to be on the painter secured in the fore part.

The coxswain should push the tiller towards the ship's side. This action will effectively cause the boat to sheer away from the parent vessel to a maximum point of sheer.

The coxswain should then move the tiller across to the opposite position, changing the aspect of the boat's bow, and so relieving the weight on the painter.

As the weight is seen to be eased on the painter, the bowman activates the release, so casting the boat clear of the parent vessel. The coxswain can now control the boat in clear sea room.

6.3 Marshalling liferafts and rescuing survivors from the sea

6.4 Recovery of survival craft and rescue boats

6.4.1 Coming alongside

The uncontrollable factors of tide, sea state, swell and general weather conditions should be taken into full account before any approach is made. In normal circumstances the approach should be made head to wind and sea, or head to tide, whichever has the greater effect on the handling of the craft.

The angle of approach varies depending on the force of the weather but can normally be expected to be around the 45˚ - 60˚ mark. A steeper angle to the wind effectively reduces the windage that the craft will experience.

The power applied should be such as to overcome the prevailing weather so that a safe, slow and manageable speed over the ground is acquired by the craft. Once alongside, the power should be maintained at a level to prevent the bow from paying off. Full use of the “bowman” and employment of the boathook in the forepart is essential when closing the objective.

When making the approach and when close in alongside expedient use of the rudder will attain the required angle of approach and also maintain the bow at a position on station. Prudent use of fenders, especially against concrete quays, or the marine growth on installations, should be regular practice to afford limited protection to heavy landings by the craft.

Should weather conditions be extreme or circumstances not permit a safe landing, either an alternative berth should be approached or the craft should have to, and stand off, until a safe approach can be made.

6.4.2 Towing operations

During the evacuation of a ship or installation, lifeboats are most certainly rescue boats are expected to collect and marshal other survival craft. These may be other lifeboats or liferafts. The towline should be of sufficient strength to achieve a successful tow to a comparatively safe area after a disaster.

When securing the towline, the length should be such that “snatching” of the line is avoided; this is specially important in choppy seas. The length of line and the speed of the towing operation should be established to prevent the towed vessel or craft from overrunning the towing craft.

Large alteration of the course should be avoided in favour of gradual turns, so avoiding excessive strain on the towline. A zig-zag course may prove more effective when it is desired to make headway into the weather, as opposed to a head-on approach.

The aim should be establish an even tension on the towline throughout the operation. Should the line be allowed to become slack with the towed craft

surging forward, a danger may arise that the towline could foul the propeller of the towing craft. The tension on the towline is directly affected by the weight aboard the craft being towed. Also, the resistance and speed of the operation cause tensions to be increased. The speed can easily be adjusted but the resistance experienced with a circular liferaft will be difficult to alleviate. In the case of a boat, removing the propeller should be considered for lengthy tow operation.

6.4.3 Control of disembarkation from survival craft

Any operation which involves the unstable platform of a small boat must, by very nature, be considered hazardous. Should weather and sea conditions be extreme, even simple procedures take on additional risk for the would-be survivors. Disembarkation from survival craft is far from a simple procedure and must be considered potentially one of the periods of greatest danger for survivors.

The coxswain- and there is only one coxswain- takes responsibility for controlling not only the craft but also the occupants. One of the greatest problems in emergencies is to control emotions which may be running high. Lack of thought by individuals, or complacency, panic or the loss of will to survive are commonplace in an emergency. These characteristics must not be allowed to develop and gather destructive momentum in the confines of a survival craft.

6.4.4 Controlling the transfer from survival craft to support vessel

Depending on the circumstances the support vessel will reduce her speed and attain a course and position stern to the wind. The freeboard height of the support vessel is critical and the mode of transfer, i.e. side ladders, nets or boarding at deck level, will be determined by it.

The survival craft will probably close the support vessel on either quarter at approximately 45˚ and hold a parallel station, adjusting speed to about 4 knots. Once the boat is also in position, stern to the wind, the forward hatch should be opened and bow-line made ready. All persons, other than bowman, should be strapped into their respective seats to provide the bottom weight for adequate stability.

The support vessel should adjust her speed accordingly to about 3.5 knots. The deck point of embarking survivors should have a guest warp rigged and additional lifebelts readily available. The deck party should be briefed to accept a bow-line from the survival craft.

Both support vessel and survival craft should maintain their existing courses and speeds alongside each other. The access door towards the support vessel should be opened and an orderly disembarkation of personnel, one at a time, should be made from the side of the survival craft. The coxswain should be the last person to disembark after closing down the boat's engine.

The survival craft will be cut away, to be recovered later or sunk.

6.5 Launching survival craft and rescue boats in rough sea

6.5.1 Use of wave-quelling oil with small boats

When engaged in heavy seas, where excessive pitching is being experienced, the prudent use of oil on the surface of the water can effectively reduce the motion of the boat. One gallon of oil is provided as standard issue to all lifeboats. This oil is usually an animal or vegetable oil, rather than a mineral oil. Coxswain are advised that the use of oil in limited quantities should prevent waves from breaking over the craft and so reduce the violent movement on the craft. The oil will not reduce any swell effects.

It is normal practice to use the oil bag in conjunction with the sea anchor and heave the boat to, with the intention of riding the bad weather out. A small amount of oil is used at any one time, ideally spread ahead of the craft to form an advancing slick giving full benefit to the boat. In a towing operation the oil should similary be spread from the fore part of the towing vessel. This will benefit both craft, the tug and the towed vessel.

Heavy oils tends to be better than lighter oils and prevent solid water landing on the top of the craft. The obvious danger is that the boat could be swamped or stove in with large waves. Comparing the pollution aspect of the use of oil with the safety of line, the priority must be in favour of safety of life at sea.

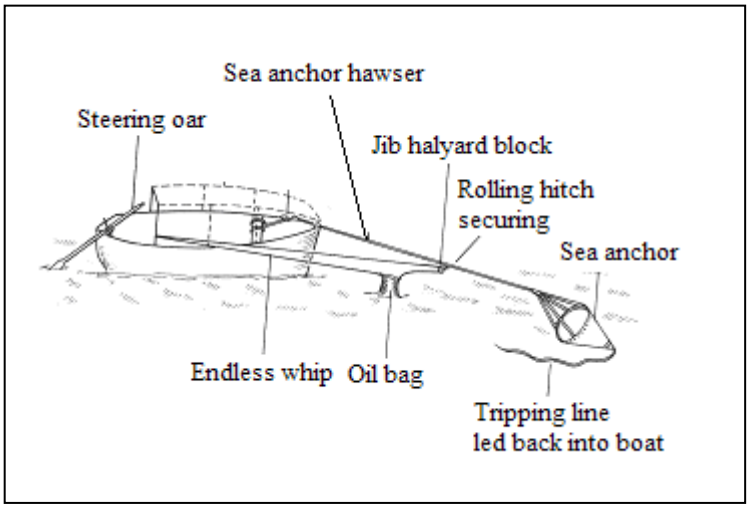


Fig. 6.12 Using of oil bag and sea anchor

7. Actions to take when clear of the ship

7.1 Immediate action checklist

- Stay clear of the airplane or ship (out of gas-saturated waters) but in the vicinity until it sinks.
- Make a thorough search for missing people. Carefully patrol the entire area near the location where the ship or plane went down, especially in the direction toward which waves are moving. Look very carefully - some people may be unconscious and floating low in the water.
- Inspect all debris that comes from the plane or ship. Salvage all rations, water containers, thermos jugs, parachutes, seat cushions, extra clothing, and maps. Look for raft supplies like the raft knife, signaling devices, and radio. Be careful with items such as sharp metal objects.
- Lash equipment to the raft or store it in raft pockets and kit containers where provided. Keep the containers closed when the equipment is not in use. Keep dry such items as flashlights, signal guns, and flares.
- Check rafts for inflation, leaks, and points of possible chafing. Bail out your raft. Be careful not to snag it with shoes or sharp objects.
- In cold oceans, wear as much clothing as possible. Rig a windbreak, spray shield, and canopy. If you are with others, huddle together; exercise regularly.
- Check the physical condition of all aboard. Give first aid. Take seasickness pills. Wash off gasoline from yourself.
- If there is more than one raft, connect rafts with at least 25 feet of line. Unless the sea is very rough, shorten the line if you hear or see an airplane. Two or more rafts tied close together are easier to spot than scattered rafts.
- Get the emergency radio into operation, if one is available. Prepare other signaling devices (such as flares) for instant use. Use these items only if surface vessels or aircraft are in plain sight.
- Keep compasses, watches, matches, and lighters dry. Place them in water-proof containers or plastic.
- In warm oceans, rig sunshade and canopy. Keep your skin covered, this is NO TIME to get a tan. Use sunburn cream and chapstick. Keep your sleeves rolled down and your socks pinned up over your pants. Wear a hat and sunglasses.
- Ration water and food (if you have no water, do not eat); assign duties; use canopy or tarpaulins for catching and storing rainwater.
- Keep a log. Record the navigator’s last fix (if possible), time and date of incident, names and physical condition of personnel, ration schedule, winds, weather, direction of swells, times of sunrise and sunset, and other navigation data. Inventory all equipment.
- Keep calm. Save water and food by saving energy. Don’t shout unnecessarily. Don’t move around unnecessarily. Keep your sense of humor sharp; use it often. Remember that rescue at sea is a cooperative project. Search aircraft contacts are limited by the visibility of survivors. Increase your visibility by

using all possible signaling devices. Keep your mirrors handy; use your radio whenever you see rescue vehicles.

7.2 After the wreckage

Use Clothing: A life jacket will save a lot of energy, but if you don't have any and can't hold on to any buoyant thing, you might be able to use some of your clothing to help you stay afloat with a minimum of energy.
Air might naturally be caught in your shirt (you might even blow in it to add some). If you have pants on, tying knots on both legs will let you capture air inside and use it as a float.
To do so hold the waistband open and swing it open in the air to fill it up and place the inflated pant-legs deep in the water holding on to the waist.
The legs full of air will float you. It might take a few tries and you might have to repeat this technique every few minutes (as the air escapes through the fabric), but it might save you some energy. Note: It might be useful to keep on shoes (to avoid injuries later. But boots might fill up with water and add weight).
Save Your Energy: If you are in the water and have nothing to help you (equipment, clothing) keep afloat. It is important to save your energy.
Unless you can swim to shore (within a reasonable distance and the current isn't against you) you should avoid swimming and save your energy as much as possible. The density of the human body is much lower than the density of salt water (and for women density is lower than men). This means that it is easy to stay afloat. However, fear often causes people to drown as exhaustion and frenzied breathing leads to swallowing water.
A few sips can cause you to drown. It is important to relax. The easiest way to save energy is to float on your back. You can become more buoyant by taking deep breaths. Some people might have difficulties with this technique (ie. diving legs). If so, lay on your stomach with your face in the water and spread your arms apart. When you need to breathe, push your arms through the water and raise your head just long enough to breathe.
This is the easiest way to float (all snorkelers have experienced it. Of course it is much easier with a mask and snorkel as you don't need to raise your head to breathe). If the sea is too rough these two techniques might not work. Use the second technique (float on your stomach), but let your legs dive in. You will almost be in an upright position (more stable in the waves). Keeping your head underwater until you need to breathe will save you a lot of energy
Avoiding Drowning: Inflatable rafts have proven to be the most seaworthy crafts to survive storms and heavy seas. Life jackets (PFD) are mandatory equipment on all vessels and represent the best personal floatation device. If you are not wearing one and can't possibly grab one or a rescue buoy at the time your ship goes under, you should try to grab on anything else that might help you keep afloat. On a dive boat, a wetsuit would be a great piece of equipment to grab). On other boats, look for anything else that will support your weight and be easy

to hold on to (plastic containers used for fuel or food storage, pieces of the boat, etc).

The first objective is to swim (or paddle) as far as possible away from the ship before it goes under. Ships can suck people under as they sink. Once the ship has sunk, if you are able to swim or paddle back to the wreckage area, you might be able to find many useful things floating around don't need to fight to keep your head out of the water). Relaxing and controlling your breathing is the key.

What are your chances to be rescued?

Were you able to send a distress signal? Did rescuers get it (did they answer you)? Where you able to send your exact location (did you know it at the time of wreckage)? Do you have any signaling and communication devices? (it is nearly impossible to find a raft in the ocean without knowing its location if no signaling (or communication) devices are onboard. Bad weather can also make searches impossible.

In open ocean if you were able to send a distress message from your boat and have low range communication and signaling equipment on your raft. Waiting for the rescue party might be the best solution.

If you don't expect any rescue team to look for you and you can see the coast (especially if the wind or current push you in that direction), you might want to try to make a sail or paddle to reach it.

If you are in the water (swimming with a life jacket or holding onto a floating object). Unless you are sure that you can swim to shore (the current is not against you), it might be better to save your energy and stay in place. Each situation will call for a different action. It is important to think about everything before deciding to leave the wreckage site.

For example, even if you had not sent any distress signals, it might be better to stay where you are if you were sailing in an area where other ships (shipping lane) or airplanes are likely to come to than to sail away to a very far island you might have seen on a map.

Where to Go

You decided to move, but you are in the middle of the ocean (no coastline on sight). Where should you go?

If you have a map. (or happen to know where you are and what is around you), deciding where to go is the biggest decision. It is possible to sail a raft, but it might be impossible to fight a current or wind to reach the closest island (even if it's only 50 miles away), but castaways have been able to drift for thousand of miles and reach land. Sailing in the opposite direction of a known close-by island might be a difficult decision to make, but it might save your life. Choose your destination based on current and wind. Avoid small islands, your chance to reach them is nearly null. It is better to aim toward a more distant but larger land mass).

You survived the wreckage, you were able to stay afloat and stay warm to prevent hypothermia (or even better climb in your raft and stay dry). Now you have to be ready to survive at sea for an unknown period of time.
Like on land, the basic survival rules apply. You must first protect yourself from the elements, then find water, and food. In addition preparing yourself to signal for help might increase your chances to be found by potential rescuers of passing ships and crafts.

7.3 Initial action in a survival craft

- Cut or release the painter and move the survival craft a safe distance from the stricken vessel. In a liferaft, before cutting the painter, pull in a much slack as possible so that the line may be used as a towing line or for other purpose as required.
- Liferaft will need to be paddled, allowed to drift down wind or towed by a motor lifeboat or rescue boat.
- Some liferafts are packed so that on inflation the sea anchor deploys automatically, so this must be recovered before attempting to paddle or tow the raft.
- When clear of the ship stream the sea anchor. This will reduce the rate of wind induced drift, in a liferaft it will increase the stability, and in a boat it will hold the head (or stern) into the wind and sea and so minimize the possibility of broaching-to. It is important to stay as close as possible to the area of the incident so that the search and rescue operation is given every chance of success. A liferaft is provided with a spare sea-anchor.
- After making sure that there is no one still in the water, that there are no useful objects to gather from the water or dangerous objects to avoid, close the entrances. In a open lifeboat erect the exposure cover and in a liferaft with as inflatable floor pump it up. When closing raft entrances use slip knots that may be easily released with cold hands. In warmer climates it may not be necessary to close both liferaft entrances.
- Maintain includes bailing and sponging out any water in the survival craft, checking for air leaks in a liferaft.

8. Lifeboats engine and accessories

8.1 Start engine

8.1.1 Starting precaution

Starting any engine can be dangerous in the hands of inexperienced people. Before attempting to start engine, the operator should be fully conversant with starting procedure and controls.

- Ensure that the batteries are in serviceable condition and correctly connected.
- Check that the oil levels in the engine and the gearbox are correct.
- Check that the all water drain plugs and cocks are closed. Check that water inlet valves, if fitted, are opened.
- Check that water level in expansion tank is filled up with mixture of water/antifreeze (40%).

8.1.2 Check before starting

- oil level in oil sump tank and gearbox
- collant level in the expansion tanker
- battery main switch is on. Oil pressure light and changing light will now be on and the buzzer will sound.

8.1.3 Manually start a motor lifeboat engine

- Check that the gear lever is in neutral position.
- Prime the fuel system if necessary.
- Check that the engine is free to turn without obstruction.
- Turn throttle control lever to almost vertical or “fast”.
- Move the de-compression lever towards the fly-wheel. Fit starting handle.
- Turn engine slowly from 3 to 20 turns to prime combustion chamber and lubricating system.
- Crank the engine really fast. When speed is obtained, return the de-compression lever to the firing position. Continue to crank until the engine fires.
- Remove starting handle and reduce engine speed as required.
- To stop the engine : turn throttle control anti-clockwise and hold it until the engine stop. Or, if fitted, pull the remote stopping control.

After starting: check the oil pressure gauge and with a water-cooled engine the overboard discharging of cooling water.

Fig. 8.1 Marine diesel engine set 380 J-3

8.1.4 Automatic starting

- Move the speed/gear box lever into neutral position by means of the control lever.
- Turn the switch to energize the starting motor.

Release immediately, if the engine start and it will return to position “O”. The alarm light as well as the buzzer should now be off.

- If the engine should fail to start, due to poor battery condition, turn the battery switch to the second start battery and repeat the starting procedure.
- If the engine fail to start in 15 seconds, despite good battery condition, release the switch and investigate the cause. The starting motor should be allowed to cool for at least 15 seconds before attempting to restart.
- At low temperature it may be necessary to ease the starting by means of the start gas.

The operational method is shown as follows:

- open the dust cover of the liquid storage. insert the pouring liquid pressure can into the hole of the liquid storage. Squeeze the can to pour the liquid into liquid storage.
- Set the gear box at idle position and put the handle of fuel rack at mid-position.
- Start the engine. At the same time, operate the hand-pump until the engine runs stably.
- If knocking appears while the engine is starting; the operation of hand-

pump must be slowed or stopped, so as to regulate the injecting liquid quantity for starting the engine stably.

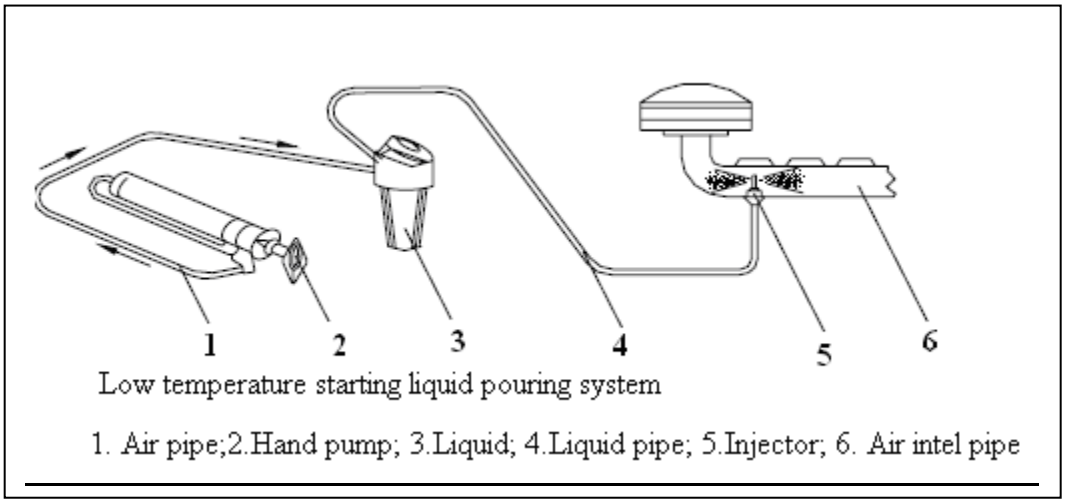


Fig. 8.2 Low temperature procedure

8.1.5 Priming the fuel system

Fill fuel tank or connect fuel supply.

Slacken each bleed screw A on top of the filter body and in the outlet banjo union. Tighten each bleed screw when a full air free flow of fuel is obtained working from the fuel tank.

Slacken bleed screw B on fuel pump nearest the tank first; tighten when all air has been displaced from fuel at each pump.

To ensure a fuel supply free of sediment and continous running in an emergency, all life boat and rescue boat fuel tanks should be thoroughly cleaned out annually.

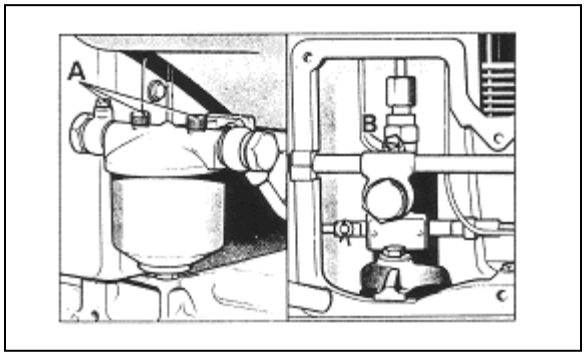


Fig. 8.3 priming the fuel system

8.2 Cooling system

The cooling system of the engine set is of forced circulative watercooling close type, which consists of lube oil radiator, water tanker, water pump, rubber pipe etc.

The cooling system of the engine is closed water cooling system.

The cooling liquid comes from the keel cooler through the lube oil cooler and water pump to the engine block, cylinder head, water cooling exhaust pipe and outlet then feed back to keel cooler to make circulation cooling.

Too high cooling temperature will cause the lamp in the control panel to light up and acoustic alarm to function.

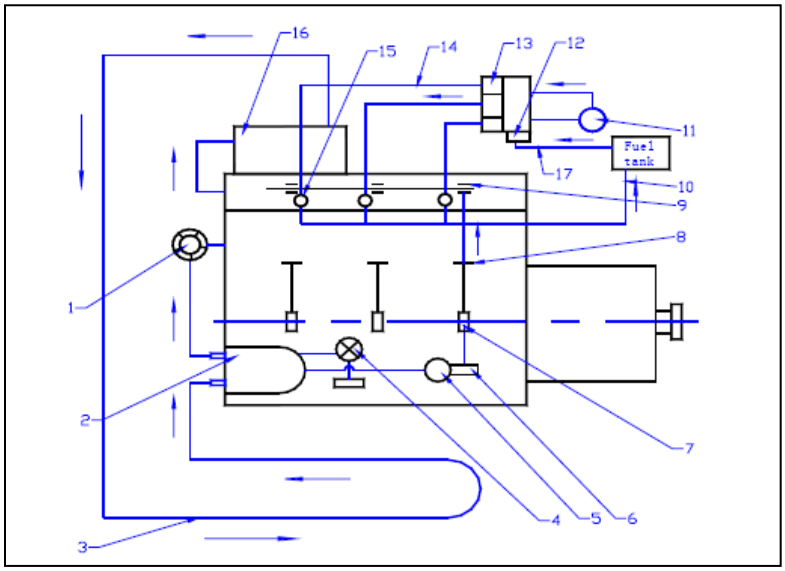
Water temperature ……..75~95□C.

Antifreeze concentration of 40% should be used as an all year round coolant. This concentration will give low temperature protection down to -25□C. Additionally, 40% concentration will protect the cooling system from corrosion.

Warning: Antifreeze contains Glycol and other constituents which are toxic if taken internally, and can be absorbed in toxic amounts under prolonged skin contact.

If antifreeze is swallowed accidentally, medical advice should be sought immediately.

Nearly all diesel engines rely on a liquid cooling system to transfer waste heat out of the block and internals. The cooling system consist of a closed loop similar to that of a car engine and contains the following major components: water pump, radiator or heat exchanger, water jacket (which consist of coolant passage in the block and heads) and a thermostat.



1.Cooling water pump 2.Lube cooler 3. Keel cooler 4.Lube oil pump 5.Lube oil filter 6.Pressure control valve 7.Main bearing 8.Camshaft bearing 9.Rocker arm 10 Overflow pipe11. Fuel oil filter 12.Fuel feed pump 13. Fuel injection pump 14. Fuel high pressure pipe 15. Fuel injection nozzle 16. Water exhaust pipe 17. Fuel oil inlet

Fig.8.4 Piping layout

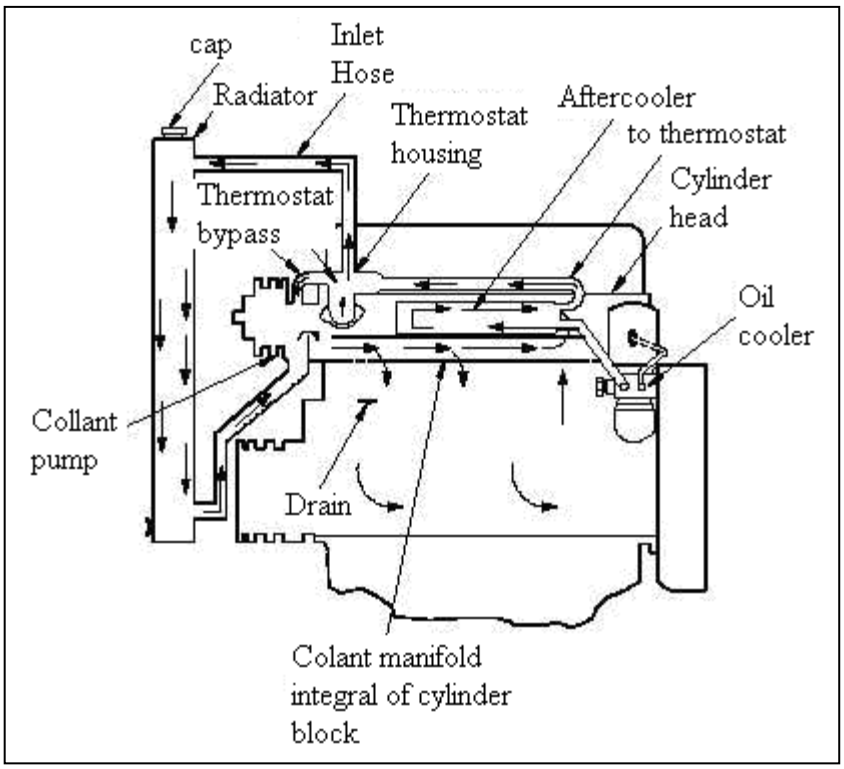


Fig. 8.5 Diesel engine cooling system

8.3 Electrical System

The electric system is composed of battery charging alternator, starting motor, relay regulator, switch, alarm buzzer, alarm lamps and instruments.

If without FQ spring starter, two separated charging battery should be need.

Voltage: 12V.

Starter motor: 2.5kw

Alternator: 750W

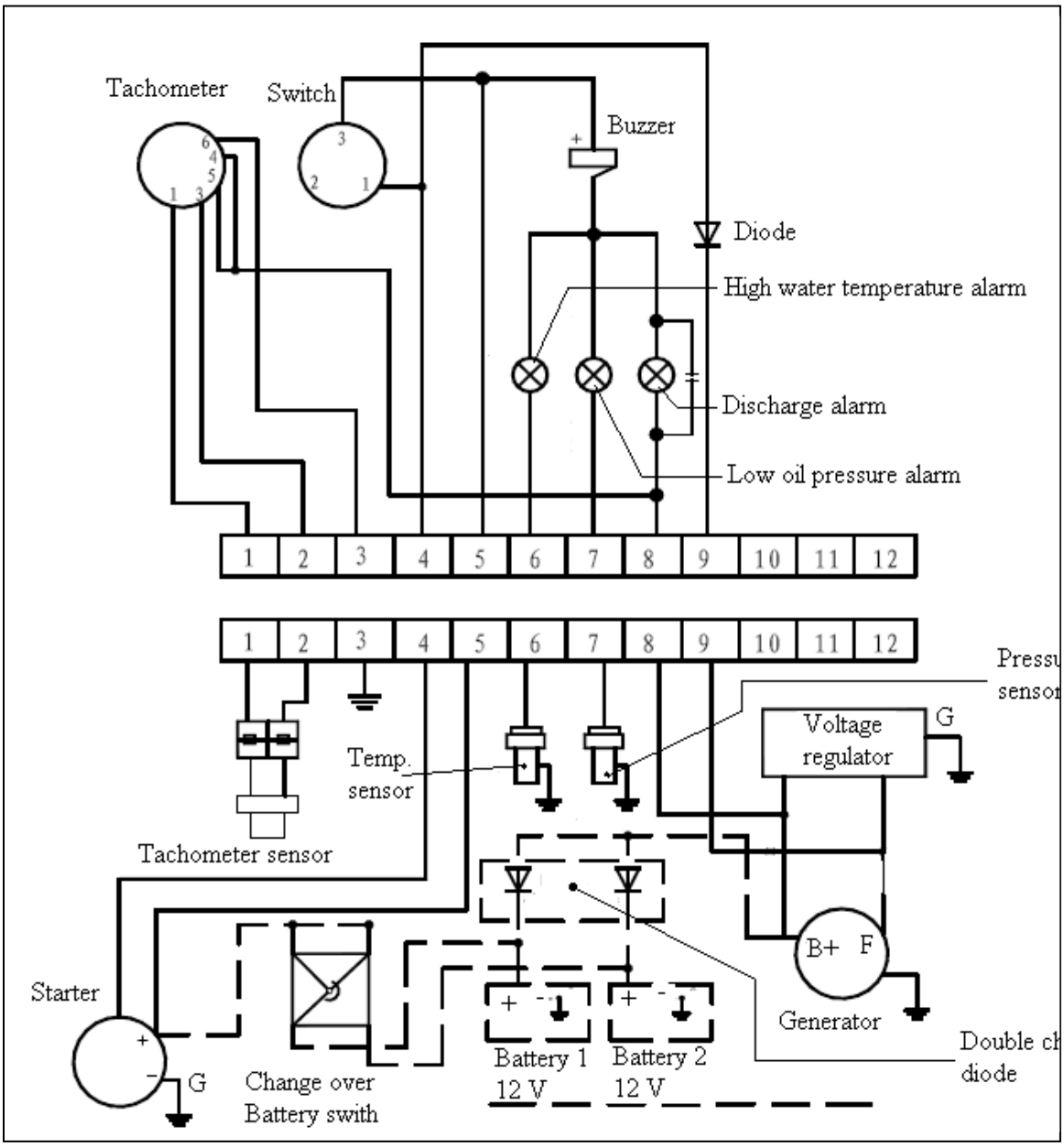


Fig. 8.6 Electrical diagram of 380 J-3

General precautions about electric system

The following points must be strictly observed when working on the electric system, otherwise serious damage can occur.

1.Never remove any electrical cable without first disconnecting the batteries.

2.Never disconnect the alternator cables while the engine is running.

3.Only disconnect the batteries with engine stopped and all switches in the OFF position.

4.Always check that cables are connected to their correct terminals before reconnecting the batteries .A reversal of polarity or short circuit will destroy diodes and transistors in the alternator and regulator.

5.Never flash any connections to check the current flow.

6.Always keep the electrical connections properly tightened.

8.4 Fire extinguisher

Dry chemical

This is the most common type, in cars as well as boats. Suitable for liquid-fuel fires like petrol (Class B fires), and it does not conduct electricity (Class E). The smaller sizes usually contain powder which is not very effective against solid fuel fires (Class A). Larger dry chemical extinguishers are suitable for A, B and E. This information is printed on the container.

Dry chemical extinguishers are filled with either foam or powder, usually sodium bicarbonate (baking soda) or potassium bicarbonate, and pressurized with nitrogen. Baking soda is effective because it decomposes at 158 degrees Fahrenheit and releases carbon dioxide (which smothers oxygen) once it decomposes. Dry chemical extinguishers interrupt the chemical reaction of the fire by coating the fuel with a thin layer of powder or foam, separating the fuel from the surrounding oxygen.

- Find the source of the fuel and shut it off. It will be very hard to put out the fire if it is constantly being fed new fuel.
- Pull the pin on your fire extinguisher.
- Aim the extinguisher on top of the fire. You want the smothering agents to fall over the top of the fire and smother it.
- Squeeze the lever on the fire extinguisher.
- Move the spray around the top of the fire. Dry chemical and foam extinguishers will leave a film across the top of the diesel fuel that keep the fire from flaring back up.
- Keep an eye on the fire site for about half an hour to ensure there are no more flare ups.

Dry chemical extinguishers usually have a locking mechanism which must be released. Aim the extinguisher at the base of the fire and squeeze the operating lever. Attack the fire near the edge and move toward the back of the fire while sweeping the nozzle rapidly from side to side. Do not point the initial discharge directly at the burning surface because the high velocity of the stream can splash and scatter the burning material, making things worse.

Fig. 8.7 Dry fire extinguishers

8.5 Water spray system
8.6 Self-contained air support system

a) FireProtection :

A water spray system is installed for fire protection. The spray system consists of an engine driven pump which takes sea water from an intake, location under the lifeboat, ensuring that no flammable is drawn into the system. The spray system provides water over the entire surface of the lifeboat. The system

includes a fresh water connection to flush through the system after testing the sprinklers and an outlet valve to pump the water out of the lifeboat without using the water spray system.

b) Air Support System :

The compressed air system has a sufficient capacity of 2x40 lt (200 bar) bottles to provide air for the maximum number of persons and engine combustion for a maximum of 10 minutes, to establish an over pressure inside the lifeboat to prevent ingress of toxic fumes or gas during fire. The pressure reducer and all the system can easily be controlled by the helmsman. It is possible to recharge the air cylinders from the ship's compressed air system without changing their places.

Spray system
(of the MK V TOTALLY ENCLOSED SURVIVAL CRAFT HellasWatercraft)

The water spray system in conjunction with the air system enables the lifeboat to proceed through oil fires without the occupants being harmed. If should be noted that whereas the water spray system will continue to operate for and unlimited time, the air system has a duration of not less than ten minutes, and fire protection is thus limited to that time.

A pump, driven by a toothed belt from the engine, takes seawater from an inlet valve in the bottom of the boat and pumps it through a system of pipes to nozzles on the lifeboat canopy. The water is spread evenly in a thin film over the whole surface of the boat by means of deflector plates fitted over the nozzles.

General maintenance of the system is as follows:

1. Check that the drill plate on the seawater inlet valve is clear and firmly fixed.
2. Check that the main water supply valve operates freely, from fully closed to fully open positions.
3. Check that the clips securing the hose to the pump are tight but not seized.
4. Ensure that the pump mounting bolts are secure and that the pump is aligned correctly.
5. Check that the toothed belt tension is correct (refer to this section of the manual).
6. Should it be suspected that the pump is not running freely, a check should be made by removing the belt and rotating the pump by hand.
7. Grease pump by rotating grease cup. Do not over tight greaser.
8. Check delivery hose.
9. Check hose clips on delivery side of plump for tightness and ensure that they are not seized.
10. Check all points for leaks.
11. Ensure that the spray pump drain line fixings are secure and that the drain valve is operational.

12. Check that the water spray film covers the whole of the boat.
13. Ensure that all spray nozzles are clear and that the spray deflectors are not damaged.
14. Wash down and de-grease the boat periodically (a layer of grease is detrimental to water coverage).

Flushing through spray system pipe work

This process is essential to prevent blockages and an accumulation of salt in the system. It should be carried out immediately after the spray system has been used or tested.

When following this procedure, make reference to the diagrammatic layout of the system following these instructions:
1. Arrange for suitable flexible hose supplying fresh water from the platform/parent vessel.
2. Pass this hose through the ventilator cowls and connect it to either forward or aft flushing points . Attached hose securely with hose clips.
3. Open flushing valve by turning anticlockwise.
4. Shut sea suction valve .
5. Leave boat after shutting all hatches. Shut all doors securely.
6. Turn on fresh water supply and leave on for about 15 to 20 minutes.
7. Observe all jets and nozzles and ensure that water is flowing freely.
8. It is quite possible that water will not discharge from the highest nozzles on the canopy or at extremities of the boat. This is because it is extremely difficult to match the capacity of the installed pump. However, those nozzles without a discharge of water should be inspected thoroughly for any obstructions.
9. When flushing is finished, turn off the water supply, enter the boat and disconnect the flexible supply hose from the flushing point , open all flushing/drain valves in the system to ensure no pockets for water remain in the system.
10. Close all flushing/drain valves and open the sea suction valve . The system will now be ready for emergency use.

Maintenance and Recharging Procedure for Air Cylinder Installation

This system provides air to enable the engine to run at maximum load rpm and for the occupants to breathe when the lifeboat is closed down and running through fire and/or toxic gases.
Under these circumstances, the air supply will last for at least ten minutes. This time will not vary even if the engine is running at slow speeds, or if the boat is not fully occupied, because the excess air will escape from the over pressure device at the aft end of the boat, preventing any excess internal air pressure.

Lever type valves on cylinders must be open when boat is to be operational. The main activating valve on the air pressure controller controlling the release of air into the boat must be closed at all times when the boat is to be

operational. This valve is to be opened when required for use in fire and/or toxic gas conditions. Check the pressure gauge regularly to ensure that the pressure does not fall below 200 bar.

Should the gauge register below 180 bar the cylinder must be recharged to its maximum of 200 bar.

However, should the pressure gauge register a low reading, a check for air leaks should be carried out before recharging. The following procedure should be followed:

Mix a strong solution of water and soap in a suitable receptacle and, with a small brush, cover liberally all joints and connections. Should there be serious leaks of air, bubbles will appear in the solution. If this occurs, tighten the appropriate connection and retest. Should the leak persist, repair as necessary.

Normal Recharging Procedure

a). The main activating valve must be in the closed position.
b). The lever type valves at the air bottles must be fully open.
c). Remove plug from the inward side of the non-return valve.
d). Attach connection from recharging unit to the non-return valve.
e). Recharge the cylinders until the gauge registers 200 bar. (It will be necessary to allow the cylinder to cool in order to measure the correct pressure). Having cooled, top-up as necessary.
f). Remove recharging unit connection.
g). Replace plug on non-return valve.

Notes:

The air supplied for bottle recharging must be of breathing quality. It must be oil-free, clean and with a water content of not more than 3 – 4 p.p.m. Excessive moisture will cause misting of the inner surfaces of the air cylinder and also can result in severe icing around the pressure controller and orifice when in the process of discharging.

If it is necessary to test the air system, facilities must be available for the immediate recharging of the bottle after the test.

9. Rescue boat outboard engine

9.1 General description

Most outboard motors are petrol-driven, two-stroke engines although four-stroke engines are becoming more common. Outboard motors may have from one to eight cylinders.

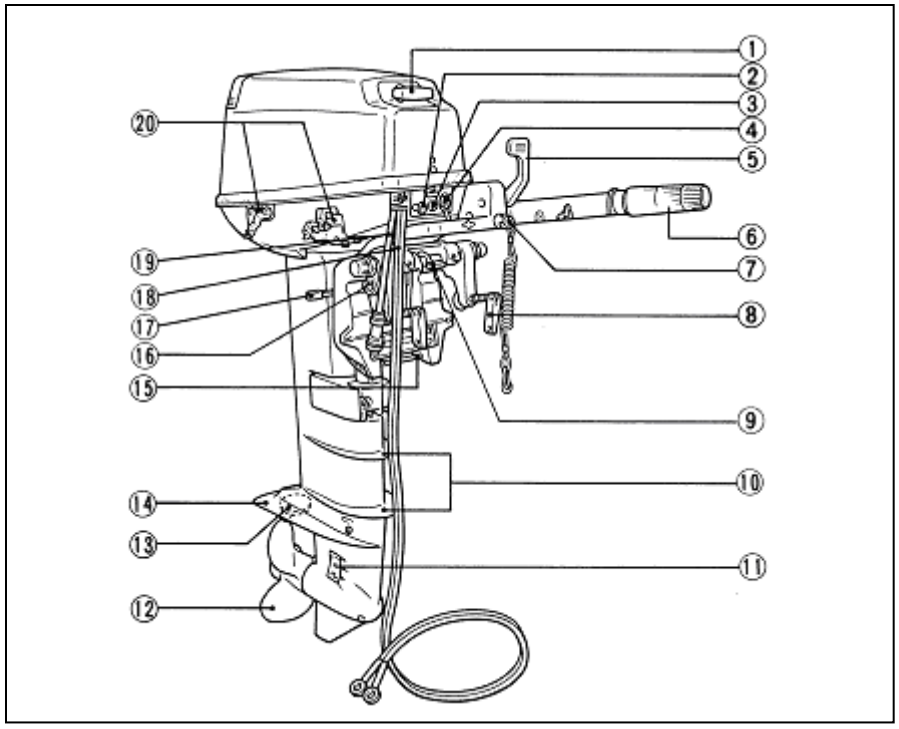


Fig. 9.1 A2-cylinder 25 HP Yamaha outboard engine

1. Manual start recoil handle
2. Choke knob
3. Overheat warning lamp
4. Electric start button
5. Gear-shift lever (usually absent on very small motors which are pivoted by 180° for reverse drive)
6. Throttle control & steering handle
7. Emergency-stop (kill) switch, lock plate and lanyard
8. Engine securing clamp
9. Tilt lock for preventing accidental tilting
10. Anti-splash plates
11. Cooling water inlet
12. Propeller
13. Zinc anode used for steering adjustment
14. Anti-cavitation plate
15. Rod for adjusting trim angle
16. Rope attachment

17. Shallow-water lever for raising motor
18. Battery lead
19. Wiring harness
20. Remote control attachment

9.2 Portable fuel system

Portable fuel tanks for outboard motors are fitted with a **manual priming bulb.** It is squeezed a few times to draw fuel when first starting the engine or to continue to provide fuel to the engine in case of fuel pump failure. Care must be taken to ensure that the bulb is not over squeezed as this may cause leaks in the fuel system or flood the engine with too much fuel, making it difficult to start. The bulb should be squeezed only until it becomes firm.

The tank is also fitted with a **breather screw**, which must be loosened to vent the tank when operating the engine. Ensure the breather screw is fully closed when transporting the tank to prevent spillage.

The fuel line connection to the tank should be self-locking, and the connection to the motor should be either the quick-release type or automatic shut- off type when the fuel line is disconnected.

Portable fuel tanks should not be left partially empty for long periods as the fuel can become contaminated with moisture buildup and algae growth. They should be filled ashore to avoid spillage on board and secured on board to prevent movement.

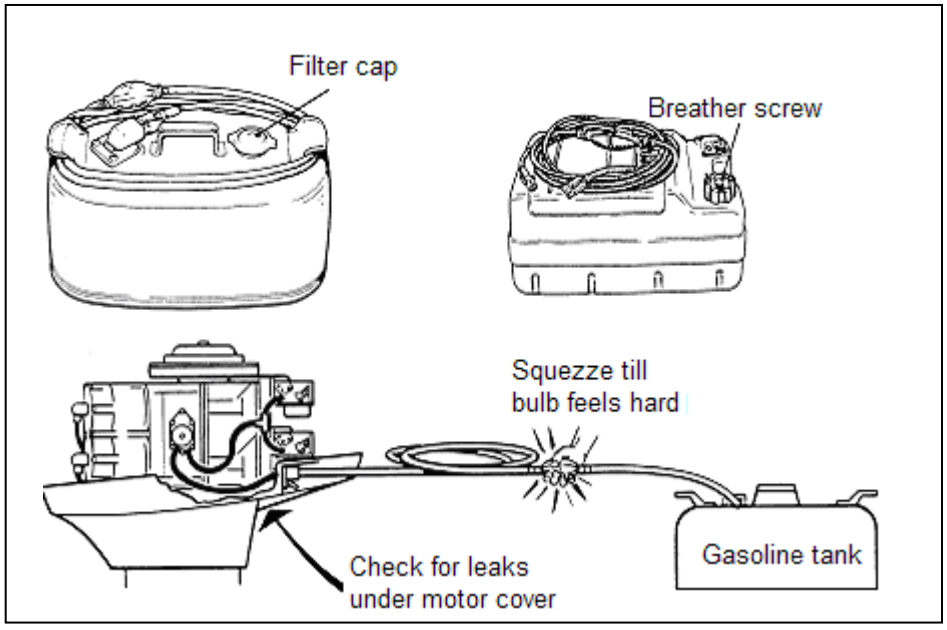
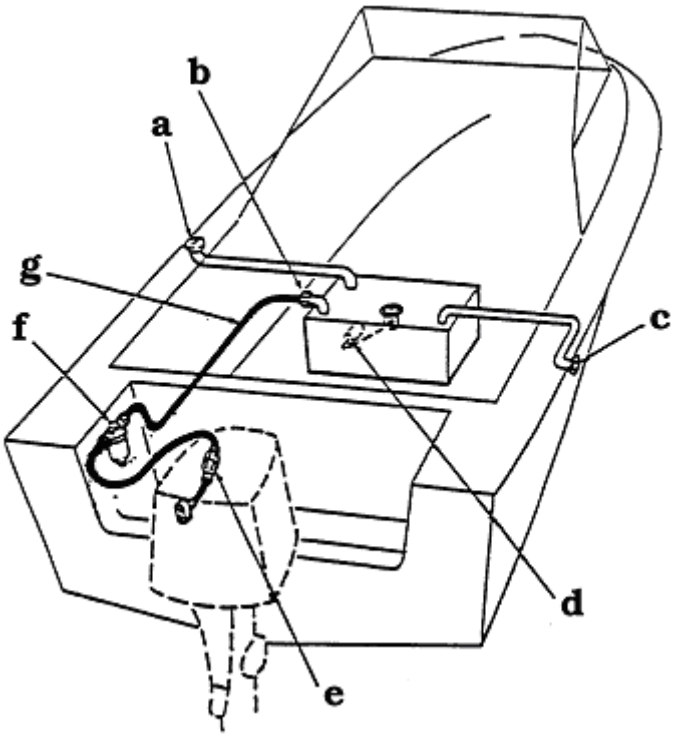


Fig. 9.2 Portable fuel system

9.3 Fixed fuel system



a. Fuel filling point/cap	e.Manual priming bulb
b. Anti-siphon fitting	f. External fuel filter
c. Fuel tank breather	g. Flexible fuel line
d. Fuel level indicator (float)	

Fig. 9.3 Fixed fuel tank

9.4 Cooling system

The outboard cooling system is the direct, raw water type. Sea water is drawn up by an impeller pump, made of plastic or rubber, which is located in the lower leg. It then passes through the galleries in the engine and out through the exhaust.

A small stream of water is also bled off somewhere in the system as a tell tale sign, indicating to the operator that water is circulating throughout the cooling system. A thermostat maintains a minimum operating temperature. An audio alarm and a “hot light” are also sometimes fitted.

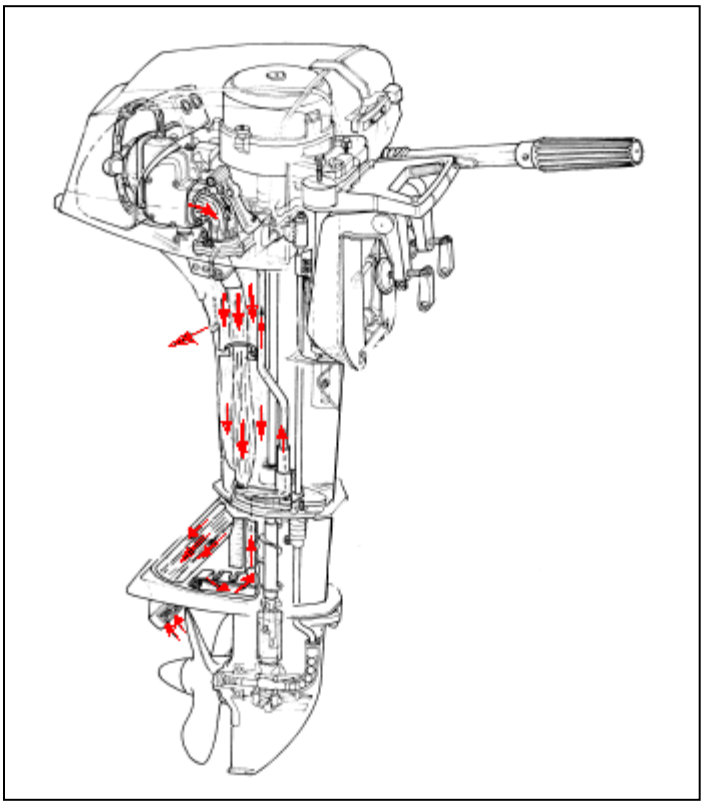


Fig.9.5 The outboard motor cooling system

9.5 Internal lubrication system

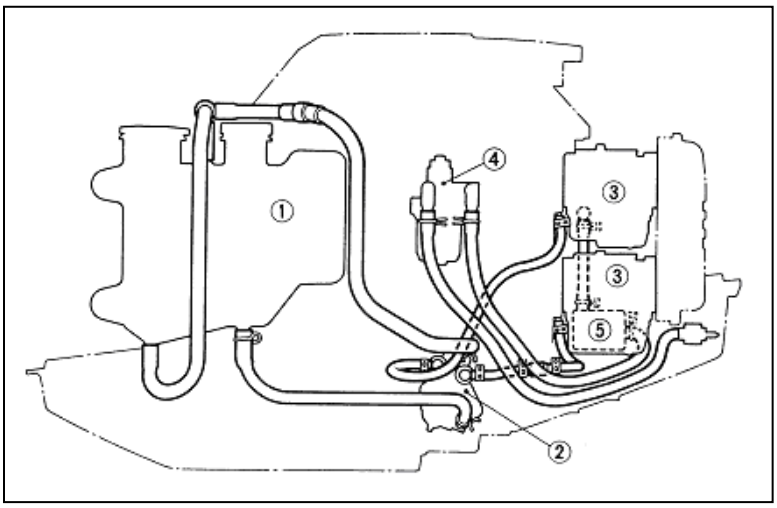
Two-stroke engines need their crankcase for compression, therefore, a circulating oil system is not possible. Their lubrication is achieved by mixing oil with petrol in one of two systems. Oil is either poured into the fuel tank and mixed by shaking or mixed as required by an oil injection pump known as the “Variable Ratio Oiling” (**VRO**). Modern two-stroke engines are usually fitted with such precision blend systems. Diesel and four-stroke petrol engines are lubricated by oil circulation from the sump (crankcase).

Insufficient oil will cause the engine to overheat and eventually seize. Excessive oil will foul the spark plugs, cause smoky exhaust and heavy carbon deposits. Both will cause engine failure.

The required amount of oil per litre of petrol varies between 1:100 and 2:100. The manufacturer’s recommendations should be followed. Paint the correct oil/petrol ratio on the fuel tank and use only the recommended two-stroke outboard motor oil.

With oil injection systems, the VRO pump automatically adjusts and mixes the amount of oil required by the engine under different conditions and speeds. It

may even be fitted with a no-oil alarm to warn the operator when the engine is receiving no oil. If the reservoir of the VRO pump runs dry during engine operation, the operator should stop the engine and refill it.



1. Lube oil tank 2. Oil injection pump 3. Carburetors 4. Fuel filter 5. Fuel pump

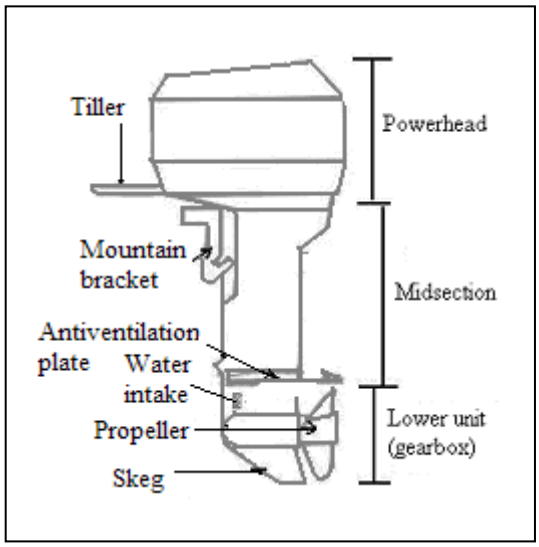
Fig. 9.6 Yamaha precision blend lubrication system (VRO)

9.6 Mounting an outboard motor

There are two methods of securing an outboard motor to the stern of a vessel.

One involves the use of hand-tightened screw thread clamps. These clamp the transom of the vessel between the engine mounting bracket and the screw thread plates. Their tightness should be checked each time the engine is used. A safety rope or chain should also be used to secure the motor to the vessel and prevent the motor from dropping from the stern if the clamps get loose during vessel operation. On larger outboard motors, the mounting bracket is usually bolted through the transom plate.

This is a more secure method, but regular checks must be made for looseness.



Motor height on the transom is an important factor in achieving optimal performance. The motor should be as high as possible without ventilating or loss of water pressure. This minimizes the effect of hydrodynamic drag while underway, allowing for greater speed. Generally, the antiventilation plate should be about the same height as, or up to two inches higher than, the keel, with the motor in neutral trim.

Trim is the angle of the motor in relation to the hull, as illustrated below. The ideal trim angle is the one in which the boat rides level, with most of the hull on the surface instead of plowing through the water.

If the motor is trimmed out too far, the bow will ride too high in the water. With too little trim, the bow rides too low. The optimal trim setting will vary depending on many factors including speed, hull design, weight and balance, and conditions on the water (wind and waves). Many large outboards are equipped with *power trim*, an electric motor on the mounting bracket, with a switch at the helm that enables the operator to adjust the trim angle on the fly. In this case, the motor should be trimmed fully in to start, and trimmed out (with an eye on the tachometer) as the boat gains momentum, until it reaches the point where further trim adjustment results in an RPM reduction. Motors not equipped with power trim are manually adjustable.

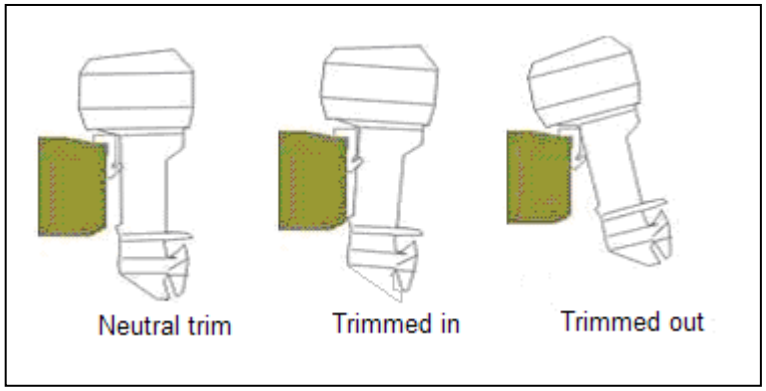


Fig. 9.7 Trim of outboard motor

Ventilation is a phenomenon that occurs when surface air or exhaust gas (in the case of motors equipped with through-hub exhaust) is drawn into the spinning propeller blades. With the propeller pushing mostly air instead of water, the load on the engine is greatly reduced, causing the engine to race and the prop to spin fast enough to result in cavitation, at which point no thrust is generated at all. The condition continues until the prop slows enough for the air bubbles to rise to the surface. The primary causes of ventilation are: motor mounted too high, motor trimmed out excessively, damage to the antiventilation plate, damage to propeller, foreign object lodged in the diffuser ring.

9.7 Starting procedure

1. Lower engine to running position and check the following
    - Fuel level
    - Oil level (if separate lube oil tank)
    - Engine mount secure
    - Propeller clear
2. Loosen air-vent screw on fuel tank cap by 2 or 3 turns (if fitted)
3. Firmly connect fuel hose to both fuel tank and engine
4. Squeeze primer bulb until it becomes firm
5. Make sure engine is in neutral, and throttle grip on handle in START position
6. Clip lock plate onto emergency-stop switch and tie lanyard to your wrist
7. Pull out choke if starting cold engine
8. Start motor by pulling starter handle (manual) or pushing starter switch (electric)
9. Push choke back in
10. Check for “tell tale” water stream and allow engine to warm up before moving off.

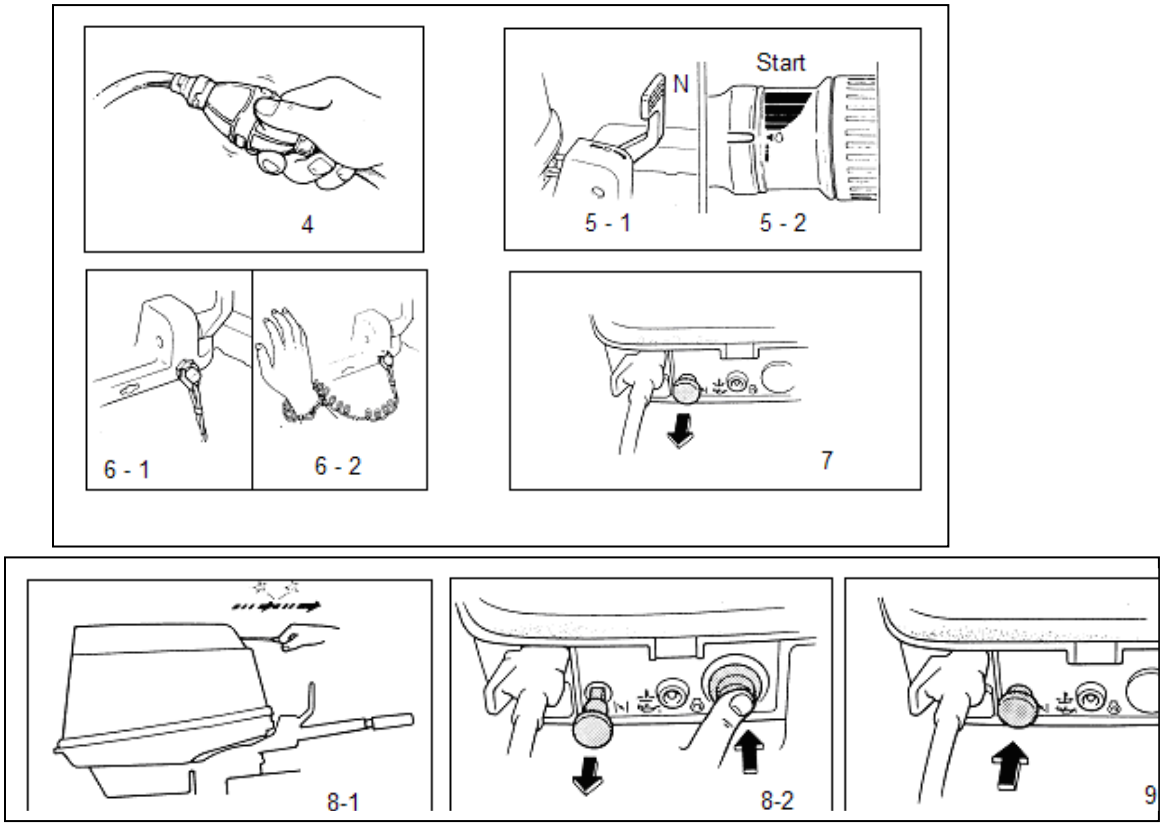
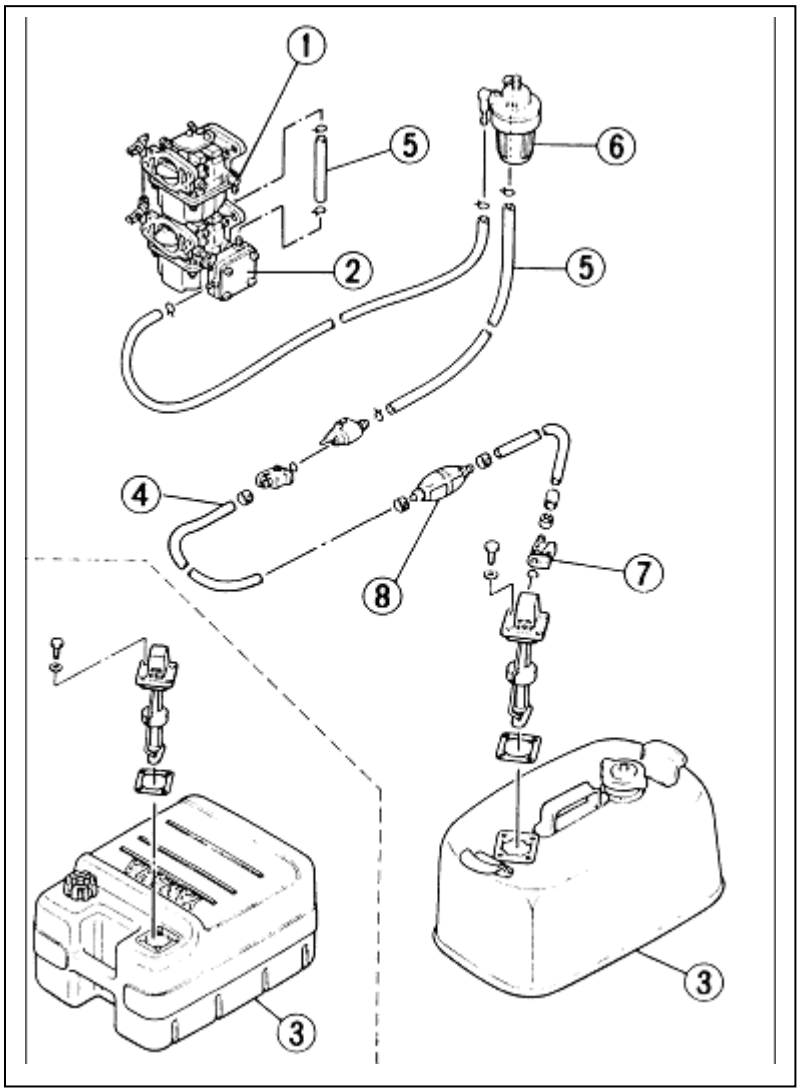


Fig. 9.8 Starting a Yamaha outboard motor

9.8 On board maintenance of outboard engine

a) Fuel system maintenance

The fuel system should be regularly inspected for leaks, cracks or malfunction.



1. Carburetor leakage
2. Fuel pump malfunction or leakage
3. Fuel tank leakage
4. Fuel hose joint leakage
5. Fuel hose cracks or other damage
6. Fuel filter leakage
7. Fuel connector leakage
8. Primer bulb leakage or damage

Fig. 9.9 Fuel system inspection

**** Cleaning the portable fuel tank and its filter*

At least **once every six months**, empty the fuel tank, pour a small quantity of detergent, and clean the tank thoroughly by shaking it.

Flush the inside with fresh water and drain it completely. Repeat the flushing and draining procedures several times until all the detergent has been removed from inside the tank.

Thoroughly clean the tank filter (located at the end of the suction pipe) with detergent and air dry.

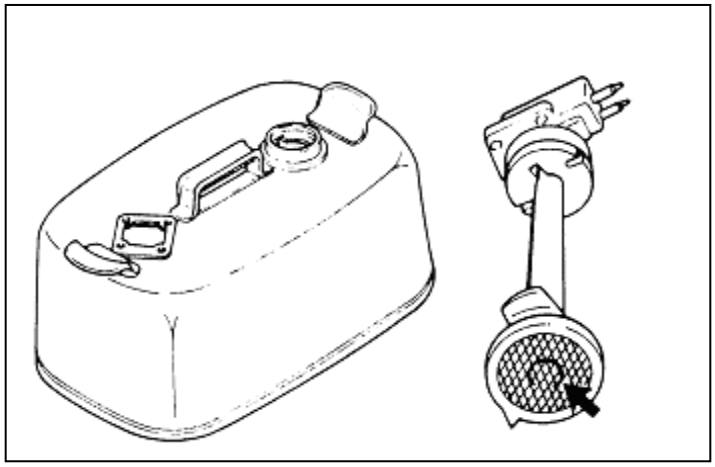


Fig. 9.10 Fuel tank and tank filter cleaning

**** Cleaning the engine fuel filter*

The engine fuel filter should be cleaned every 20 hours of operation or every month. In some countries, the fuel quality is poor so cleaning of the filter should be carried out more frequently.

Stop the engine before removing the filter. Keep away from sparks, cigarettes, flames or other sources of ignition.

Remove the fuel hoses and clean the filter with detergent. Air dry the filter then put it back in place making sure the filter case is tightly screwed.

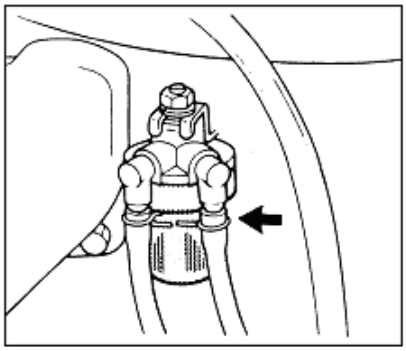


Fig.9.11 Fuel filter cleaning

b) <u>Gear Box oil change</u>

Gear-box oil should be changed every 100 hours of operation or **six monthly**, whatever comes first.

Drain the gear-box into a container by opening the oil-drain plug (2) then the oil-level plug (1). With the outboard motor in the upright position, inject the recommended gear-box oil into the oil-drain plug hole (2) until it starts to flow out of the oil-level plug hole (1). Insert and tighten both the drain plugs.

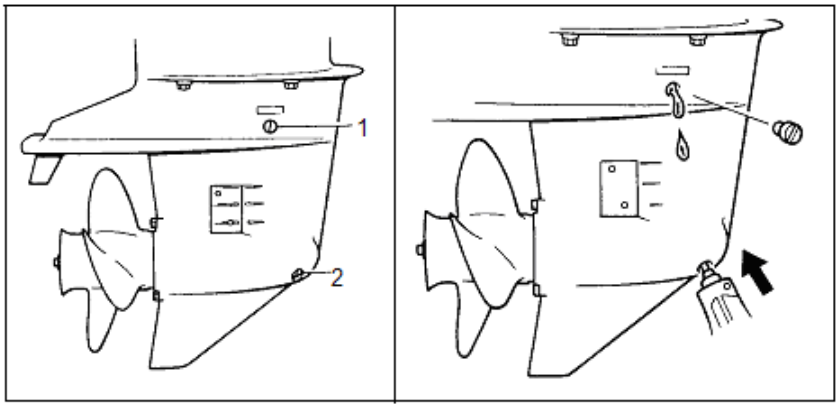


Fig. 9.12 Changing the gear box oil

c) External lubrication

Every three months, a recommended(marine) grease should be injected through the specified points (grease nipples) on the outboard motor. This procedure will ensure all moving parts operate smoothly.

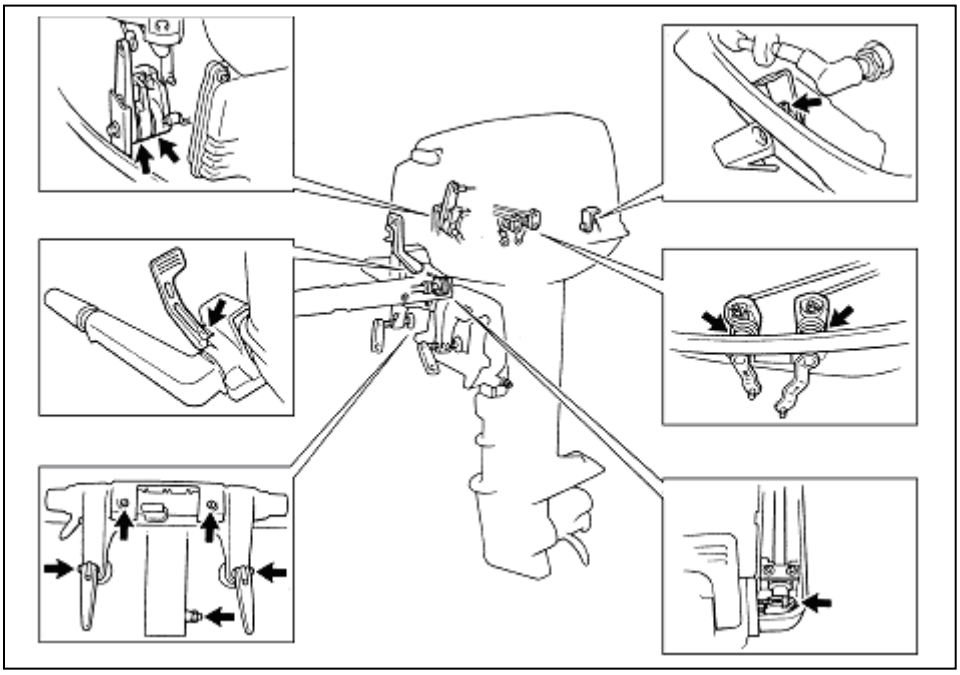


Fig. 9.13 Yamaha grease points

d) Cooling system

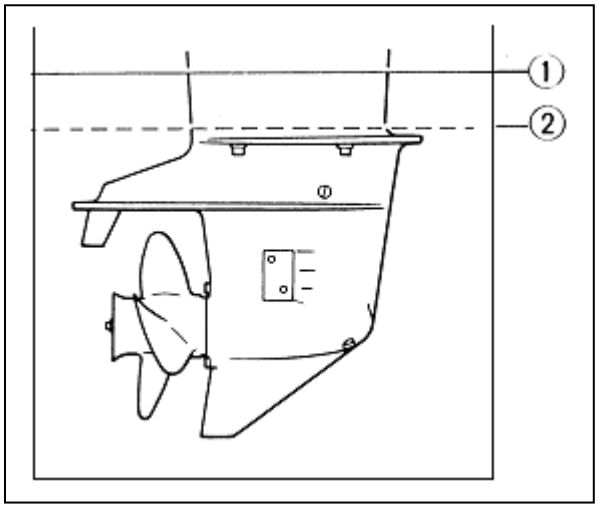
The outboard motor cooling system is the part of the engine most likely to cause problems due to salt, sand and dirt entering the system. Water pumps should be inspected and the pump impeller changed every 200 hours of operation or once a year, whatever comes first.

It is important to keep an eye on the tell tale water stream as a drop in flow is likely to indicate a problem with the cooling system. It could be a blockage around water intakes (plastic bags in the water are a common cause), sand in the system, water pump failure, damaged pump impeller and so on. It may also simply be a blockage of the outflow (sand) from the tell tale although the engine cooling system is operating correctly.

Flushing the cooling system with fresh water

You can help prevent some of the problems caused by salt buildup in and around the motor by washing the body and flushing the cooling system with fresh water after use. To clean the cooling water passages, mount the motor in a tank partly filled with fresh water (water level above the anti-cavitation plate). Put the motor into neutral, start and run at low speed for a few minutes. This procedure should be carried out at least once every month.

If possible, run the engine in fresh water on completion of each trip.



1. Water surface 2. Lowest water level

Fig. 9.14 Cooling system

e) Fuses, Batteries, Propellers, Zinc anodes

Fuses protect electrical wiring and equipment from damage or fire due to electrical overloads. A fuse is designed to melt when overheated due to excessive current flowing through an electrical circuit. The circuit becomes open, no more current flows through it and therefore the electrical equipment is protected.

If a fuse does “blow”, it should be replaced with one that is recommended for that purpose.

Some spare fuses should be carried on board in case this happens. If a fuse repeatedly “blows”, it indicates a serious problem which should be looked at by a qualified person to find the cause.

Batteries should be inspected regularly to make sure they are secured in place to stop movement as a vessel rolls. They should also be kept topped up with distilled water to just above the plates. Batteries must be kept dry and clean, and the connections tight. The terminal posts should be coated in Vaseline to prevent them from corroding.

Batteries contain hydrogen gas, which is highly explosive so must be kept clear of sparks, heat, flames, lit cigarettes and so on. They also contain acid, which burns the skin so must be handled carefully.

Propellers are easily damaged by hazards in the water, hitting the bottom and corrosion. Even slight damage can cause a reduction in speed.Propellers on outboard motors are fitted with a shear pin, which is designed to break, if the propeller hits a solid object. The pin is easily replaced.

If a propeller blade is bent or badly chipped, it is best to fit a new propeller as it will not work very well. Make sure you only fit a propeller, which is recommended by the outboard manufacturer.

Every three months, the propeller should be pulled off and the propeller shaft greased.

A *zinc anode* is fitted near the propeller to prevent corrosion and should be replaced when almost worn away. The zinc anode should be pulled off and scrubbed once every three months.

9.9 Periodic inspection and service

The following table is given as a guideline for periodic maintenance procedures.

These inspections and services are recommended for outboard motors used on an average of 20 hours per month. Depending on operating conditions, the intervals between maintenance procedures may need to be changed.

PROFICIENCY IN SURVIVAL CRAFT AND RESCUE BOATS OTHER THAN FAST RESCUE BOATS

SERVICES \ INTERVALS	1 MONTH	3 MONTHS	6 MONTHS	1 YEAR	2 YEARS
RUN ENGINE IN FRESH WATER	X				
FUEL FILTER: CHECK & CLEAN	X				
SPARK PLUGS: CHECK CONDITION & CHANGE IF NECESSARY	X				
PROPELLER: PULL OFF & CLEAN PROPELLER SHAFT		X			
ZINC ANODE: PULL OFF & SCRUBB		X			
ENGINE HEAD: FLUSH w/ FRESH WATER, CLEAN, SPRAY CRC, GREASE		X			
ENGINE LUBRICATION: GREASE THE SPECIFIED POINTS		X			
FUEL TANK: CLEAN w/ DETERGENT & FRESH WATER			X		
CRANKCASE: DRAIN & REFILL w/ OIL			X		
IMPELLER: REPLACE IMPELLER & GREASE CRANKSHAFT				X	
FULL SERVICE BY AUTHORISED DEALER					X

10. Handling survival craft and rescue boats in rough weather

10.1 Using sea-anchor and oilbag

Throw out the sea anchor, or improvise a drag from the raft's case, bailing bucket, or a roll of clothing.

A sea anchor helps you stay close to your ditching site, making it easier for searchers to find you if you have relayed your location.

Without a sea anchor, your raft may drift over 160 kilometers in a day, making it much harder to find you.

You can adjust the sea anchor to act as a drag to slow down the rate of travel with the current, or as a means to travel with the current. You make this adjustment by opening or closing the sea anchor's apex. When open, the sea anchor acts as a drag that keeps you in the general area.

When closed, it forms a pocket for the current to strike and propels the raft in the current's direction.

Additionally, adjust the sea anchor so that when the raft is on the wave's crest, the sea anchor is in the wave's trough.

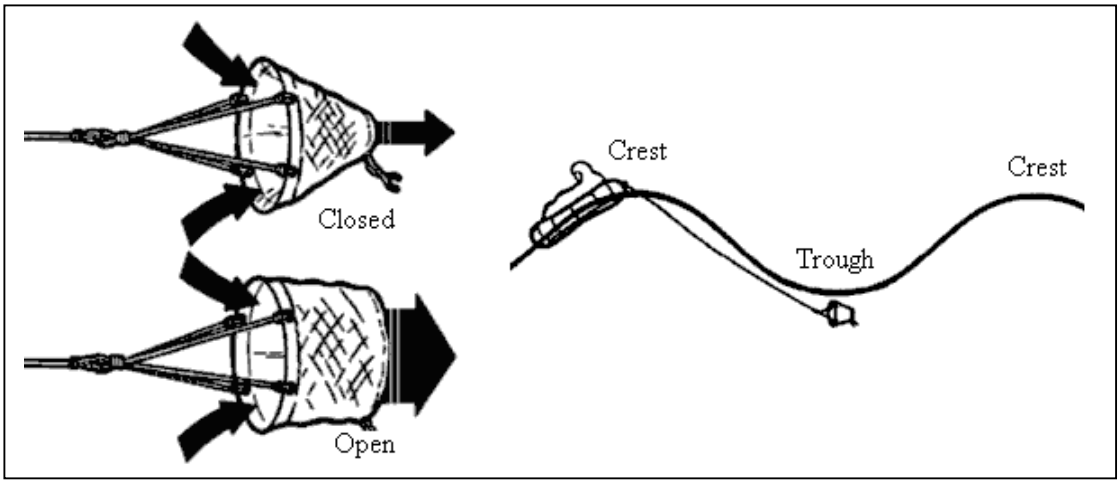


Fig. 10.1 Sea anchor and deployment of sea anchor

When engaged in heavy seas, where excessive pitching is being experienced, the prudent use of oil on the surface of the water can effectively reduce the motion of the boat. One gallon of oil is provided as standard issue to all lifeboats. This oil is usually an animal or vegetable oil, rather than a mineral oil. Coxswain are advised that the use of oil in limited quantities should prevent waves from breaking over the craft and so reduce the violent movement on the craft. The oil will not reduce any swell effects.

It is normal practice to use the oil bag in conjunction with the sea anchor and heave the boat to, with the intention of riding the bad weather out. A small amount of oil is used at any one time, ideally spread ahead of the craft to form an advancing slick giving full benefit to the boat. In a towing operation the oil should similary be

spread from the fore part of the towing vessel. This will benefit both craft, the tug and the towed vessel.

Heavy oils tends to be better than lighter oils and prevent solid water landing on the top of the craft. The obvious danger is that the boat could be swamped or stove in with large waves. Comparing the pollution aspect of the use of oil with the safety of line, the priority must be in favour of safety of life at sea.

If the weather continues to to deteriorate and the boat labours badly, take the jib halyard block off the mast head band and bend the two ends of the halyard together to make endless fall. Haul in about two fathoms (3.7m) of the se anchor hawser and bend the jib halyard block onto the hawser, then pay the hawser out again.

Put a little oil in the oil bag, cork the bag and make it fast to the jib halyard. Haul the bag a little way out towards the sea anchor. The oil will seep out of the bag and help prevent the seas from breaking and the boat will be able to lie better to the sea anchor. The best position for the oil bag will have to be found by experiment. If the weather is very cold and the oil to thick to seep through the bag, prick the bag a few times with a sail needle or something similar.

10.3 Beaching

10.3.1 Detecting land and general information regarding rafting or beaching techniques

Detecting Land

You should watch carefully for any signs of land. There are many indicators that land is near.

A fixed cumulus cloud in a clear sky or in a sky where all other clouds are moving often hovers over or slightly downwind from an island.

In the tropics, the reflection of sunlight from shallow lagoons or shelves of coral reefs often causes a greenish tint in the sky.

In the arctic, light-colored reflections on clouds often indicate ice fields or snow-covered land. These reflections are quite different from the dark gray ones caused by open water.

Deep water is dark green or dark blue. Lighter color indicates shallow water, which may mean land is near.

At night, or in fog, mist, or rain, you may detect land by odors and sounds. The musty odor of mangrove swamps and mud flats carry a long way. You hear the roar of surf long before you see the surf. The continued cries of seabirds coming from one direction indicate their roosting place on nearby land.

There usually are more birds near land than over the open sea. The direction from which flocks fly at dawn and to which they fly at dusk may indicate the direction of land. During the day, birds are searching for food and the direction of flight has no significance.

Mirages occur at any latitude, but they are more likely in the tropics, especially during the middle of the day. Be careful not to mistake a mirage for nearby land. A mirage disappears or its appearance and elevation change when viewed from slightly different heights.

You may be able to detect land by the pattern of the waves (refracted) as they approach land.. By traveling with the waves and parallel to the slightly turbulent area marked "X" on the illustration, you should reach land.

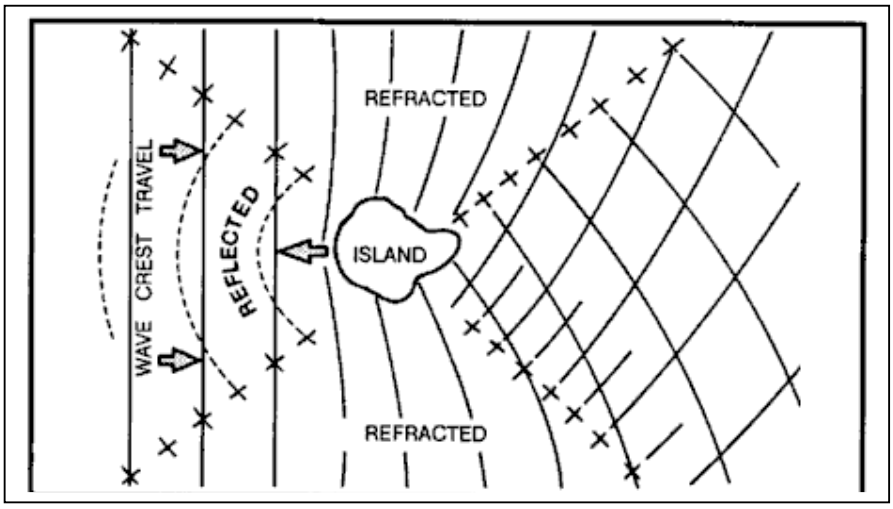


Fig. 10.2 Wave patterns about an island

Rafting or Beaching Techniques

Once you have found land, you must get ashore safely. To raft ashore, you can usually use the one-man raft without danger. However, going ashore in a strong surf is dangerous. Take your time. Select your landing point carefully. Try not to land when the sun is low and straight in front of you. Try to land on the lee side of an island or on a point of land jutting out into the water. Keep your eyes open for gaps in the surf line, and head for them. Avoid coral reefs and rocky cliffs. There are no coral reefs near the mouths of freshwater streams. Avoid rip currents or strong tidal currents that may carry you far out to sea. Either signal ashore for help or sail around and look for a sloping beach where the surf is gentle.

If you have to go through the surf to reach shore, take down the mast. Keep your clothes and shoes on to avoid severe cuts. Adjust and inflate your life vest. Trail the sea anchor over the stem using as much line as you have. Use the oars or paddles and constantly adjust the sea anchor to keep a strain on the anchor line. These actions will keep the raft pointed toward shore and prevent the sea from throwing the stern around and capsizing you. Use the oars or paddles to help ride in on the seaward side of a large wave.

The surf may be irregular and velocity may vary, so modify your procedure as conditions demand. A good method of getting through the surf is to have half the men sit on one side of the raft, half on the other, facing away from each other. When a heavy sea bears down, half should row (pull) toward the sea until the crest passes; then the other half should row (pull) toward the shore until the next heavy sea comes along.

Against a strong wind and heavy surf, the raft must have all possible speed to pass rapidly through the oncoming crest to avoid being turned broadside or thrown end over end. If possible, avoid meeting a large wave at the moment it breaks.

If in a medium surf with no wind or offshore wind, keep the raft from passing over a wave so rapidly that it drops suddenly after topping the crest. If the raft turns over in the surf, try to grab hold of it and ride it in.

As the raft nears the beach, ride in on the crest of a large wave. Paddle or row hard and ride in to the beach as far as you can. Do not jump out of the raft until it has grounded, then quickly get out and beach it.

If you have a choice, do not land at night. If you have reason to believe that people live on the shore, lay away from the beach, signal, and wait for the inhabitants to come out and bring you in.

If you encounter sea ice, land only on large, stable floes. Avoid icebergs that may capsize and small floes or those obviously disintegrating. Use oars and hands to keep the raft from rubbing on the edge of the ice. Take the raft out of the water and store it well back from the floe's edge. You may be able to use it for shelter. Keep the raft inflated and ready for use. Any floe may break up without warning.

10.3.2 Beaching a boat

- well outside the line of surf, let fly sheets, down helm and bring the boat head to wind.
- stream sea anchor. Dredge a grapnel if one is available.
- send down the sails and strike the mast.
- unship the tiller and rudder. Ship the steering oar.
- man the oars.
- let the boat drift slowly in; keeping her head to sea.
- beach the boat stern first. Everyone should disembark over the stern, as quickly as possible.

If you make a sandy beach with surf running ; you will have to beach the boat. Never attempt to do this in the dark, stand-off until day light.

Altought the surf may not look much from seaward, it will be terrifying when the boat is in it.

The important thing is to keep the boat’s head to sea all the time.

Whenever a large breaker is bearing down towards the boat, give way together and row into it, letting the boat ride in on the back of each sea and keeping the sea anchor out all the time, to help you keep head to sea.

If as you are coming in, the wind should drop and become an off-shore breeze, it will not have any effect on the sea and no heed need be paid out.

When the boat is beached, no one is to be allowed to leave the boat over the bow or amidship, because there is always a strong undertow which could carry them out to sea.

Take the painter ashore with you. Do not lose the boat.

You will often see boats running before the surf and beaching bow first. This method is not advised for an inexperienced crew landing on a strange beach. Do remember to keep everyone seated as low as possible and so far as you can towards the bow but out of the ends of the boat.

10.3.3 Beaching the liferaft

Well outside any line of surf the liferaft should be prepared for taking the beach by inflating the double floor. The entrances to the liferaft should be in the open and tied-off position with one or both sea anchors steamed.

The paddles should be used to maneouvre the liferaft opposite a sandy, sloping beach, free of rocks or other obstructions. These paddles should be kept ready to fend off and provide limited control to the raft when approaching the beach.

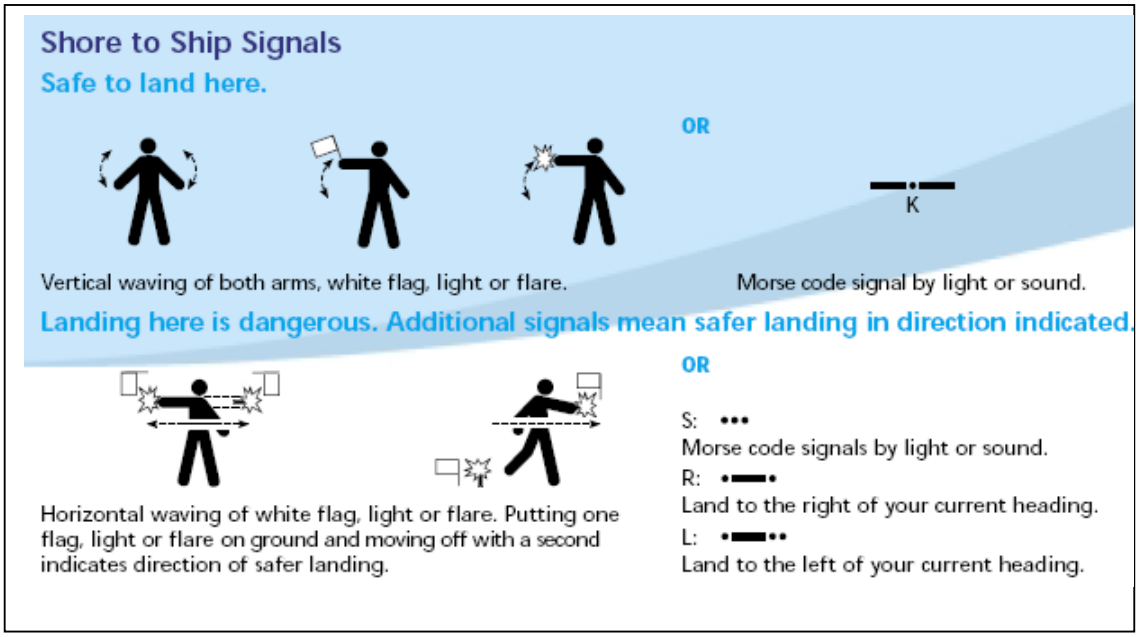
Prior to moving into the surf all persons should have immersion suits on and/or lifejackets. If the choice is available the liferaft should be beached during the hours of daylight. Since the liferaft is without motive power circumstances could well determine when the beaching will actually take place, beyond the control of persons inside the craft.

During the operation the liferaft should be allowed to drift towards the beach by tripping and holding the weight on the sea anchor. A sharp lookout should be maintained for rocks or dangerous obstructions. The paddles should be keep handy to fend off as and when appropriate.

Once the liferaft has entered shallows two men should endeavour to disembark and pull the craft higher up on to the beach, clear of the surf action. Other survivors should disembark as soon as practicable with a view to saving themselves together with as much of the life-support systems as possible. The liferaft itself should, if possible, be salvaged. The orange canopy acts as an efficient location aid while the liferaft provides shelter and warmth to distressed persons.

Subsequent actions following a beaching operation would be initially to check other survivors and check for injuries/casualties. Ensure all salvaged goods are clear of the water line and leave the liferaft exposed, clear of tree overhangs and the like.

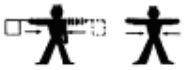
10.3.4 Landing signals for the guidance


Shore to Ship Signals
Safe to land here.
OR
K
Vertical waving of both arms, white flag, light or flare.
Morse code signal by light or sound.
Landing here is dangerous. Additional signals mean safer landing in direction indicated.
OR
S: •••
Morse code signals by light or sound.
R: •▬•
Land to the right of your current heading.
L: •▬••
Land to the left of your current heading.
Horizontal waving of white flag, light or flare. Putting one flag, light or flare on ground and moving off with a second indicates direction of safer landing.

This is the best place to land

	MANUAL SIGNALS	LIGHT SIGNALS	OTHER SIGNALS
Day Signals	Vertical motion of a white flag or of the arms	Green star signal	Code letter K by light or sound signal apparatus
Night Signals	Vertical motion of a white light or flare	Green star signal	Code letter K by light or sound signal apparatus

Landing here highly dangerous

	MANUAL SIGNALS	LIGHT SIGNALS	OTHER SIGNALS
Day Signals	 Horizontal motion of a white flag or arms extended horizontally	Firing of a red star signal	Code letter S by light or sound signal apparatus
Night Signals	Horizontal motion of a light or flare	Firing of a red star signal	Code letter S by light or sound signal apparatus

Landing here highly dangerous. A more favorable location for landing is in the direction indicated

	MANUAL SIGNALS	LIGHT SIGNALS	OTHER SIGNALS
Day Signals	 Horizontal motion of the white flag, followed by : - the placing of the white flag in the ground and - by the carring of another white flag in the direction to be indicated	 Firing of a red star signal vertically and a white star signal in the direction towards the better place	Signallizing the code letter S followed by code letter R if a better landing place is located more to the right in the approach direction Signallizing the code letter S followed by code letter L if a better landing place is located more to the left in the approach direction
Night Signals	 Horizontal motion of a white light or flare: - followed by the placing of the white light or flare on the ground - the carrying of another white light or flare in the direction to be indicated.	 Firing of a red star signal vertically and a white star signal in the direction towards the better landing place	Signallizing the code letter S followed by code letter R if a better landing place is located more to the right in the approach direction Signallizing the code letter S followed by code letter L if a better landing place is located more to the left in the approach direction

Fig. 10.3 Landing signals

11. Actions to take when aboard a survival craft

11.1 Initial action
11.2 Routines for survival

Initial vital action are :

- Cut the painter using the knife provided
- Stream the sea anchor, to reduce the risk of capsize and reduce the rate of drift.
- Close up the acces points, to restrict incoming water and protect from exposure.
- Maintain the craft, after checking for immediate damage.

Survivors should realize that by cutting the painter they are allowing the liferaft to clear the area of immediate hazard, such as the side of an installation or the side of a sinking parent vessel. Once the painter is cut, endeavours to move the raft into clear water should be made by means of the paddles provided. Another method of manoeuvre, for a circular craft, is to throw out the sea anchor and pull the liferaft towards the weighted drogue.

It should not be the intention of survivors to clear the immediate disaster area. The rate of drift on a inflated liferaft is considerable and unless a safe haven is within sight, the sea anchor should be streamed at an early stage to effectively reduce the drift and maintain the craft at the site of the last noted position.

It may be some time before the rescue services can locate survivors and it is essential for the life raft entrances to be closed up to protect the occupants from exposure. The floor should also be inflated at an early stage, when in cold climates, to gain added insulation. This can also be deflated when in a warmer climate, to gain an opposite cooling effect. Once the liferaft is closed up the natural body heat of survivors will add to the interior warmth. When considered appropriate, ventilation can later be allowed within the raft confines.

Survival in a liferaft needs to be managed correctly to bring about a successful rescue. The maintenance of the craft needs to be managed by a person designated leader. This is not to say that a dictatorial attitude should prevail, on the contrary constructive ideas should be encouraged with a view to combined expertise providing better solutions.

The other vital actions are :

- *Sea sickness tablets* : it is imperative that all survivors take the seasickness medication as soon as practicable after boarding. Seasickness will incapacitate a person, and to be useful a survivor needs to be both mentally and physically aware.
- *Dry out* the survival craft : bale out loose from inside the liferaft/lifeboat with balers provided. Employ one or two sponges to mop up dregs.
- *Post a lookout* : establish a lookout on the exterior of the liferaft .The lookout should listen and watch for other survivors and locate other survival craft if possible. An inside lookout should also be established to continually check the buoyancy compartments of the liferaft and watch out for damage being

accidentally caused. The internal lookout can also keep a regular check on the condition of casualties.

- *Treat injured parties* : the welfare of injured parties should be considered as soon as practicable, but not to the detriment of the well-being of the liferaft. Use of the first aid kit is limited to the prevailing conditions.
- *Handbook / instructions*: the waterproof instructions should be read out loud, so that all occupants are reassured that what is being carried out is correct survival procedure.

It is important that the " will to survive " is maintained throughout all survival procedure. Good morale is essential to maintain confidence in eventual rescue.

Circumstances may well alter the order of events in which they take place but in general the following should occur :

- the person elected to take charge of the craft should carry out a roll-call/head count and examine the relevant expertise within the craft.
- A working routine should be established and discipline maintained from the outset of the situation. A watch system should be brought into operation to govern outside and inside duties.
- If survivors can communicate their location either by use of the EPIRBs, SARTs, VHF or other similar means, these should be activated as soon as practicable.
- A continuous lookout should be maintained in order to collect other survivors or locate other craft, or attract the attention of the rescue service. All wreckage should be saved if it is useful, and sharo obstructions should be given a wide berth.
- Lookouts should be made aware of the position of pyrotechnics and how they work, the instructions being read well before they actually need to be used. By letting personnel read the instructions on equipment, and designating various job functions the minds of survivors are kept active. Morale is maintained and the will to survive is not lost.

It is essential in any situation like this to do what it is necessary to do. Very often to do nothing is the correct approach. By resting and conserving energy there is less burn-up of body fluid and the body's resources.

- In stormy water, rig the spray and windshield at once. In a 20-man raft, keep the canopy erected at all times. Keep your raft as dry as possible. Keep it properly balanced. All personnel should stay seated, the heaviest one in the center.
- Calmly consider all aspects of your situation and determine what you and your companions must do to survive. Inventory all equipment, food, and water. Waterproof items that salt water may affect. These include compasses, watches, sextant, matches, and lighters. Ration food and water.
- Assign a duty position to each person: for example, water collector, food collector, lookout, radio operator, signaler, and water bailers.

Note: Lookout duty should not exceed 2 hours. Keep in mind and remind others that cooperation is one of the keys to survival.

- Keep a log. Record the navigator's last fix, the time of ditching, the names and physical condition of personnel, and the ration schedule. Also record the winds, weather, direction of swells, times of sunrise and sunset, and other navigational data.
- If you are down in unfriendly waters, take special security measures to avoid detection. Do not travel in the daytime. Throw out the sea anchor and wait for nightfall before paddling or hoisting sail. Keep low in the raft; stay covered with the blue side of the camouflage cloth up. Be sure a passing ship or aircraft is friendly or neutral be-fore trying to attract its attention. If the enemy detects you and you are close to capture, destroy the log book, radio, navigation equipment, maps, signaling equipment, and firearms. Jump overboard and submerge if the enemy starts strafing.
- Decide whether to stay in position or to travel. Ask yourself, "How much information was signaled before the accident? Is your position known to rescuers? Do you know it yourself? Is the weather favorable for a search? Are other ships or aircraft likely to pass your present position? How many days supply of food and water do you have?"

11.3 Use of equipment

11.3.1 The heliograph

A small waterproof mirror. On a sunny day you can flash the sun's rays at a passing ship or helicopter. Keep it up for long enough, and somebody may realise that the flashing is not a window randomly catching the sun.

The mirror should be at least 10 cm square and of good optical quality. If you can't see your face in it, bright, clear and in perfect detail, it will do a poor job of reflecting sunlight. That describes most stainless steel mirrors.

Glass mirrors are much better although prone to break if dropped. Plastic mirrors are lightest but need to be kept in a soft pouch so the surface does not get scratched.

For aiming, a signal mirror may have a small hole in the middle and a thin sighting rod, or a built-in optical aiming system.

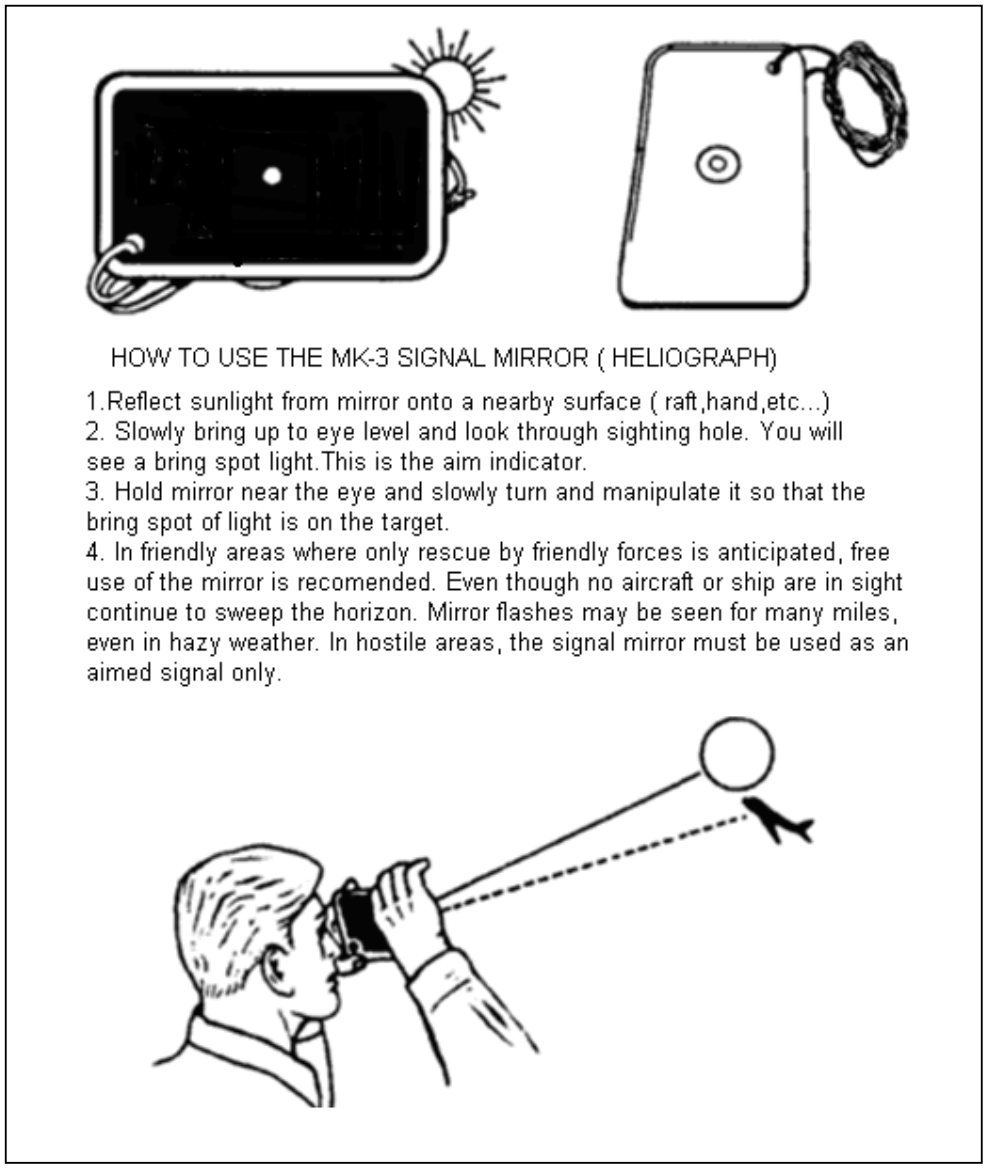

HOW TO USE THE MK-3 SIGNAL MIRROR (HELIOGRAPH)
1.Reflect sunlight from mirror onto a nearby surface (raft,hand,etc...)
2. Slowly bring up to eye level and look through sighting hole. You will see a bring spot light.This is the aim indicator.
3. Hold mirror near the eye and slowly turn and manipulate it so that the bring spot of light is on the target.
4. In friendly areas where only rescue by friendly forces is anticipated, free use of the mirror is recomended. Even though no aircraft or ship are in sight continue to sweep the horizon. Mirror flashes may be seen for many miles, even in hazy weather. In hostile areas, the signal mirror must be used as an aimed signal only.

Fig.11.1 Use of heliograph

11.3.2 Use of equipment

See the liferaft equipment description at page 14 of the present chapter.

11.4 Apportionment of food and water

11.4.1 Rations

It is recommended that no rations are issued for at least the first 24 hour period from the time of evacuation from the parent vessel.
However, rainwater should be collected from the outset to supplement water rations later. If the liferaft contains casualties, and they are conscious, water may be administrated to them within the first 24 hours.

Survivors should eat only the rations provided and in no circumstances should survivors drink or eat any of the following : seawater or urine, fish, seabirds, turtles (protein foods such as fish absorb body fluids and should not be eaten without a plentiful supply of water).

11.4.2 Ration issue

When rations are given out to survivors, follow the instructions. When used correctly there is an adequate supply for the full complement of the liferaft for 4 days. In a prolonged rescue rations should not be cut until the fourth day.

Continue to supplement rations with rainwater and/or condensation. The second sponge can be gainfully employed to collect condensation from the inner canopy of the liferaft. Old ice is another useful supply of water when located in ice region.

The above procedure are intended for use with inflatable liferaft. Because of obvious differences in construction from rigid craft the procedures may alter to suit the circumstances, i.e. the majority of rigid craft have an engine and their role in an emergency could differ considerably.

11.4.3 Short Water Rations

When you have a limited water supply and you can't replace it by chemical or mechanical means, use the water efficiently. Protect freshwater supplies from seawater contamination. Keep your body well shaded, both from overhead sun and from reflection off the sea surface. Allow ventilation of air; dampen your clothes during the hottest part of the day. Do not exert yourself. Relax and sleep when possible. Fix your daily water ration after considering the amount of water you have, the output of solar stills and desalting kit, and the number and physical condition of your party.

If you don't have water, don't eat. If your water ration is two liters or more per day, eat any part of your ration or any additional food that you may catch, such as birds, fish, shrimp. The life raft's motion and anxiety may cause nausea. If you eat when nauseated, you may lose your food immediately. If nauseated, rest and relax as much as you can, and take only water.

To reduce your loss of water through perspiration, soak your clothes in the sea and wring them out before putting them on again. Don't overdo this during hot days when no canopy or sun shield is available. This is a trade-off between cooling and saltwater boils and rashes that will result. Be careful not to get the bottom of the raft wet.

Watch the clouds and be ready for any chance of showers. Keep the tarpaulin handy for catching water. If it is encrusted with dried salt, wash it in seawater. Normally, a small amount of seawater mixed with rain will hardly be noticeable and will not cause any physical reaction. In rough seas you cannot get uncontaminated fresh water.

At night, secure the tarpaulin like a sunshade, and turn up its edges to collect dew. It is also possible to collect dew along the sides of the raft using a sponge or cloth. When it rains, drink as much as you can hold.

11.4.4 Rainwater

You may collect more water by catching rainwater. Some parts of the inflatable life raft canopy are designed to catch water. Rainwater catchment tubes will take the water into storage bags on the inside of the raft. The storage bags are in the raft's equipment container. Salt spray may dry on the canopy. The salt might be washed in with the first few ounces of rainwater. It might be very difficult to collect uncontaminated rainwater when the seas are rough and waves are constantly being blown onto the canopy.

The lookout should alert everyone when it rains. Use and fill all available containers with rainwater (such as equipment accessories bag, ration packs, and empty tin cans). After all of the containers have been filled, everyone should drink as much of the rainwater as they can.

Water might condense on the inside canopy of the inflatable life raft. Use one of the cellulose sponges that is provided in the raft equipment to soak up the water. Squeeze the water out of the sponge to drink or store. Be sure to keep a sponge clean for this purpose.

In the Arctic Sea, you can collect "old saltwater ice." It is bluish in color with smooth, rounded corners. It is usually pure enough to eat or drink. Do not make the mistake of eating "salt ice." "Salt ice" is gray and milky. It should not be eaten.

11.5 Action to take to maximize detectability and location of survival craft

The importance of a good lookout cannot be overstated. Remember, when in a life raft, you are so small and the sea is so big that it is very easy for a search ship or plane to overlook you. An alert lookout will make the difference in survival. Once you have sighted a rescue ship or aircraft, use the following to attract their attention:

Signaling mirrors **:** Read the instructions for the particular kind of signaling mirror in your survival equipment. Do not wait until you see a rescue craft to use the signaling mirror. When the sun is shining, flash the mirror all around the horizon. An aircraft can spot the flash long before you would see the aircraft. The signaling mirror may save your life. Use it as long as the sun is shining. (Fig.11.1)

Whistles : In calm weather, your voice can be heard only a few hundred yards away. If you keep screaming, you will become hoarse and lose your voice. A whistle, on the other hand, can be heard up to 4 miles away in favorable weather conditions. It can come in handy when you are floating in the water trying to attract the

attention of nearby rescuers. A whistle can be used over and over again. It can be used in fog, at night, or during the day.

Pyrotechnics: These are signals such as rockets, flares, and smoke. Instructions for operating various brands of pyrotechnics are written by the manufacturers. Once you are settled in your survival craft, read the instructions on each type of pyrotechnic so you will know how to use them when a ship or aircraft is spotted. Keep the pyrotechnics close by for immediate use, so you can signal when necessary. Heed the following when using pyrotechnics:

- Be sure to fire the signals downwind on the lee side of the survival craft. When firing hold them at a slight angle over the water.

Pyrotechnics have burning particles that might fall, which may burn you or damage the raft.

- Only use smoke signals during the daytime. Smoke does not glow in the dark. Only use pyrotechnics when you can see a ship or plane. Do not waste smoke signals.
- Rockets should be used when a vessel is spotted far away on the horizon. A rocket will get the signal higher, where it can be seen from a greater distance.
- An aircraft directly overhead would be more likely to spot a hand flare than a flare covered with a parachute.

EPIRBs : All EPIRBs rely on satellite relay of distress messages, but there are distinct types. Standard 406 MHz EPIRBs such as the Satellite2 send a coded signal with a Unique Identifier Number (UIN).

Newer GPS-enabled 406 MHz EPIRBs such as the GlobalFix iPro also transmit position information along with the identifier. Time is saved by not having to wait for successive passes of the satellite to determine a position fix on the beacon. All 406 MHz EPIRBs are either Category I, meaning they will deploy automatically if the vessel sinks or Category II, meaning they need to be manually deployed.

If your EPIRB is floated, tie it to the survival craft, so it will not drift away

Automatic activation

EPIRB MP-406 is automatically activated during free emersion from depth of 4 meters after release from automatic release device.

EPIRB is automatically activated after it emerged to water by water sensor. EPIRB can be thrown from deck to water surface after its manual release from bracket or automatic release device. (not high then 20 meters).

Manual activation

To activate the EPIRB manually installed in bracket:

a. Upholding the EPIRB by case, pull out the pin and release the EPIRB from bracket.

b. Turn the switcher to “ON” position.

After EPIRB activation one long flash of light-emitted beacon and alternately flashing of “402/121” flashes by red color and then by green color show that EPIRB operates normally.

After manual activation EPIRB can be installed in lifeboat. Avoid any conducting things in radius of 1.5 meters or things shaded the antenna in tilt angles from 7 to 70 degrees.

After manual activation EPIRB can be also emerged to water. But note that you should fix it to lifeboat with help of 7m floating line.

Fig. 11.2 EPIRBs ARC Global Fix iPro, Global Fix Pro and ACR Satellite

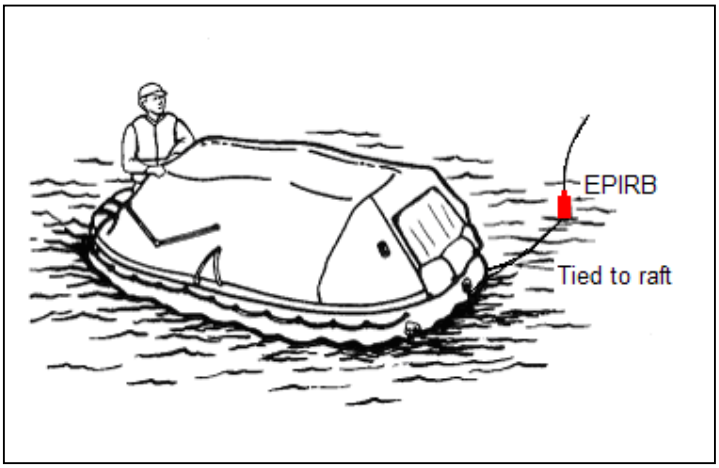


Fig.11.3 EPIRB secured to a liferaft

SARTs **:** SART installations include one or more search and rescue locating devices. These devices may be either a radar-SART (Search and Rescue Transponder), or (from 1.January 2010) an AIS-SART AIS-SART (AIS Search and Rescue Transmitter). The radar-SART is used to locate a survival craft or distressed vessel by creating a series of dots on a rescuing ship's radar display. A SART will only respond to a 9 GHz X-band (3 cm wavelength) radar. It will not be seen on S-band (10 cm) or other radar.

The radar-SART may be triggered by any X-band radar within a range of approximately 8 nautical miles (15 kilometers). Each radar pulse received causes it to transmit a response which is swept repetitively across the complete radar frequency band. When interrogated, it first sweeps rapidly (0.4 microsecond) through the band before beginning a relatively slow sweep (7.5 microseconds) through the band back to the starting frequency. This process is repeated for a total of twelve complete cycles.

In some cases, lifeboats have passive radar reflectors, made up of light metal at sharp angles, intended to reflect energy efficiently. They are less than ideal, as they can be bulky and not at all useful for rafts or personal floatation gear. SART, however, are much more efficient as radar beacons. They conserve battery life by only operating a receiver, unless they detect an X-band pulse. When they detect such as signal, they transmit an X-band signal in response, which will appear as a bright radar target.

Further, the signal they send is not a single dot, but a pattern that will direct rescuers. A SART sends a sequence of twelve pulses, timed, at first detection, so they will display with the actual SART at the position of the first dot, and the remainder radiating toward the edge of the screen. As the rescuers approach, the dots will become short arcs. The closer the search radar gets to the SART, the larger the arcs, until, when the SART is very near.

SARTs, like any marine rescue signaling device, work best when they are elevated above sea level, distancing them from "clutter" caused by waves. If at all possible, the SART should be mounted about 2 meters above the floor of a liferaft.

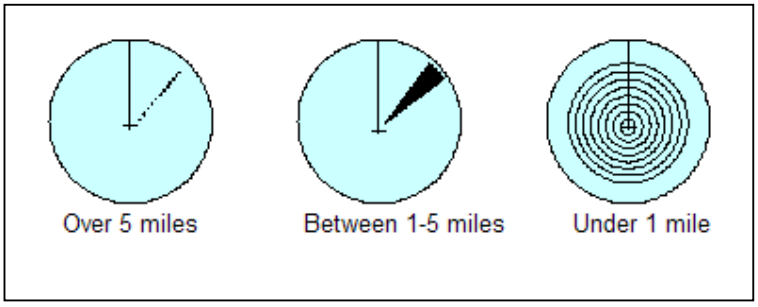


Fig.11.4 Signals of SART on radar screen

Fig.11.5 Different types of SARTs

Radar reflector : A radar reflector is a device which is attached to a boat to make it more visible on radar. Radar reflectors consist of several pieces of metal which intersect with each other to create a geometric shape which will strongly reflect radar. There are a number of different styles and designs available, and several boating safety organizations have tested a range of radar reflectors to see which models and designs seem to work best, obtaining varying results which seem to indicate that even with a radar reflector, a boat can sometimes be hard to spot on radar.

A radar reflector reduces navigational hazards by providing a surface for radar to bounce from, generating a return which can clearly be read on radar screens. This will allow larger ships to clearly see small boats in front of them, which can help captains reduce the risk of collision. Using a radar reflector also makes a craft like a lifeboat more visible on radar, allowing it to be found more quickly.

Fig. 11.6 Different types of radar reflectors

2 way VHF radio:

- Transmits and receives on VHF Channels 16 and 6
- Capable of withstanding total immersion to 10 ft. (3.3 m)
- Floats to prevent being lost overboard like other radios
- Can be stored in a survival craft for up to 5 years
- Easily User-replaceable "push/twist/lock" battery; 5 year replacement life
- Operating life: 8 hours @ -20° C (-4° F), longer in temperate waters
- The radio is equipped with a 5 year lithium survival battery pack
- Unit meets all IMO, SOLAS and FCC requirements for survival craft two-way VHF transceivers.
- An optional rechargeable MaxCap battery pack is also available.

ACR - Survival Craft Radio 16-6 Model 2726A

The 16/6 Survival Craft Portable Two-Way VHF Radiotelephone is intended to be used for on-scene emergency communications between survival craft and ship, and survival craft and rescue units. The radio is equipped with a 5 year lithium survival battery pack which is user replaceable. With the lithium battery pack installed, the unit meets all IMO, SOLAS and FCC requirements for survival craft two-way VHF transceivers. An optional rechargeable MaxCap™ battery pack is also available.

SENDING DISTRESS COMMUNICATIONS

The following are a set of observations intended to help the user maximize his success during the course of a rescue where two-way communication is possible.
1. Transmit only when the channel is clear of activity, or between other stations' transmissions during a distress.
2. Use the world recognized expression M'AIDER or MAYDAY to call for help. Note that MAYDAY is commonly pronounced as it is read in English, when utilized in English speaking countries. To improve the chances of being understood internationally, it is best to pronounce the above expression two ways:

a. The internationally recognized way, *M'AIDER* (in French) pronounced phonetically as “mĕ - dĕ,” and,

b. The commonly used pronunciation in English speaking countries MAYDAY pronounced phonetically as “mā - dā.”

To prevent the distress signal from being misunderstood, and to improve the intelligibility of the distress call, use the two pronunciations above when calling.

Antenna height and range of communications are intimately related. In general, a higher antenna will have a longer range than a similar lower antenna.

The typical range for a transmitting radio held at about 1.2 meters (4.0 ft) above average water level is expected to equal 4.5 kilometers (2.8 statute miles). The receiving shipborne antenna can extend the range if it is mounted high. Airborne receivers greatly extend the above range (over 150 kilometers/100 miles for aircraft flying over 1500 meters/5000 ft).

Because of the above fact, and to maximize the range of the survival craft VHF radiotelephone, the unit should be held as high as possible without endangering the safety of the operator.

CHANNEL 16 OPERATION

1. Remove control panel protective cover.
2. Strap the unit around operator's wrist, hand or glove.
3. Press ON/OFF button for one (1) second to turn ON the Survival Radio.
4. CHAN 16 button stays lit (red).
5. Listen for the tone and for the squelch action 3 seconds after activating the unit.
6. Press blinking PUSH TO TALK button to transmit.
7. Speak loudly and clearly into speaker area from a distance of approximately 3"to 6" (7.5 cm to 15 cm).
8. Both Volume indicators stay lit during transmission.
9. Release PUSH TO TALK button to listen.
10. Adjust Volume by pressing the respective buttons (Note: there are 4 preset volume settings from which to choose).
11. Keep transmissions to a minimum to conserve battery power.
12. Periodically verify that the CHAN 16 button is lit (red) to guard against accidental selection of channel 6.
13. Press ON/OFF button to turn unit off.

CHANNEL 6 OPERATION

1. Remove control panel protective cover.
2. Strap the unit around operator's wrist, hand or glove.
3. Press ON/OFF button for one (1) second to turn on the Survival Radio.
4. CHAN 16 button stays lit (red)
5. Listen for the tone and for the squelch action 3 seconds after activating the unit.
6. Press CHAN 6 button to select channel 6.
7. CHAN 6 button stays lit (green).
8. Adjust Volume by pressing the respective buttons (Note: there are 4 preset volume settings from which to choose).
9. Press blinking PUSH TO TALK button to transmit.
10. Speak loudly and clearly into speaker area from a distance of approximately 3"—6" (7.5 cm to 15 cm).
11. Both Volume indicators stay lit during transmission.
12. Release PUSH TO TALK button to listen.
13. Keep transmissions to a minimum to conserve battery power.
14. Press ON/OFF button to turn unit off.

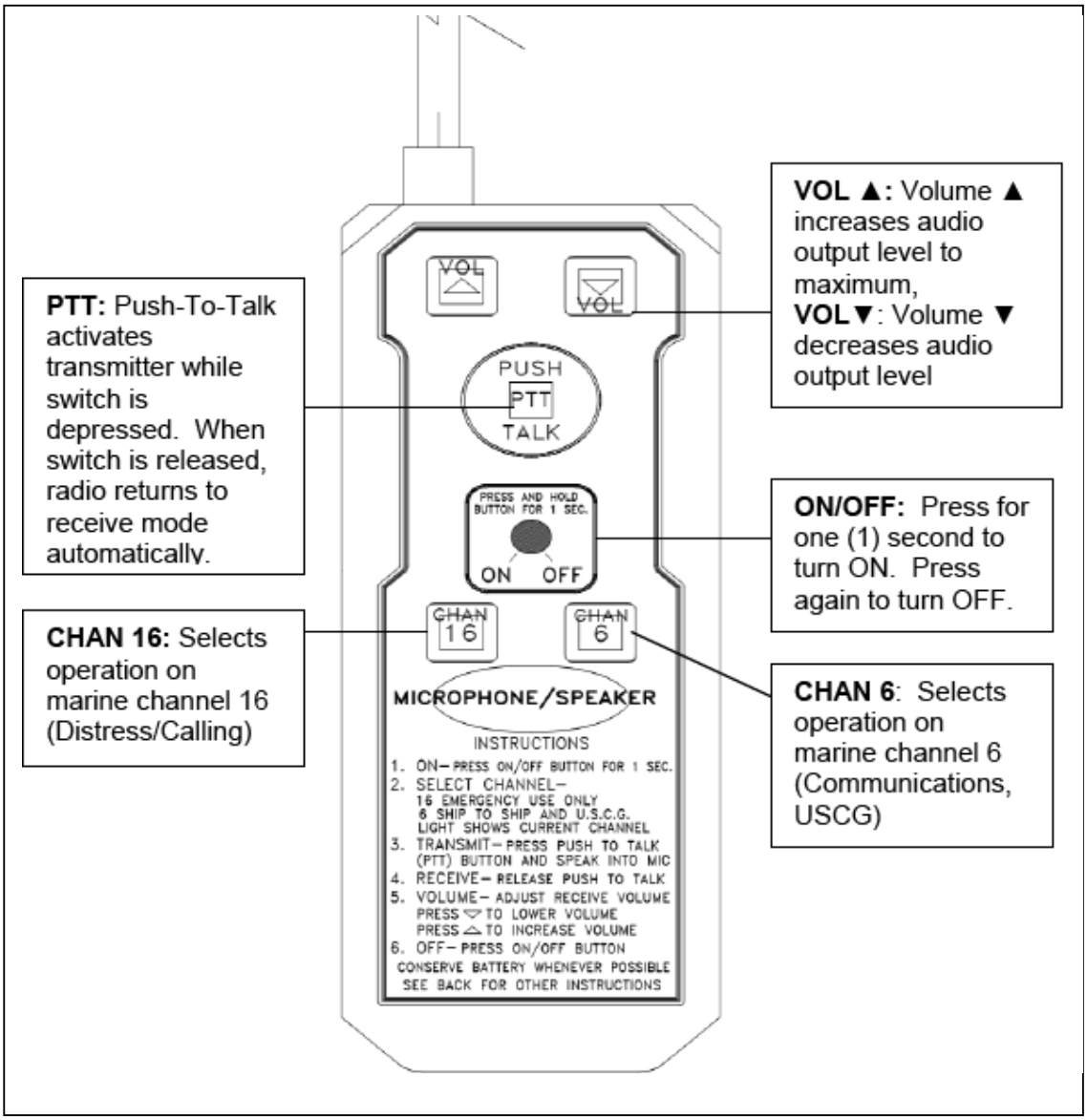
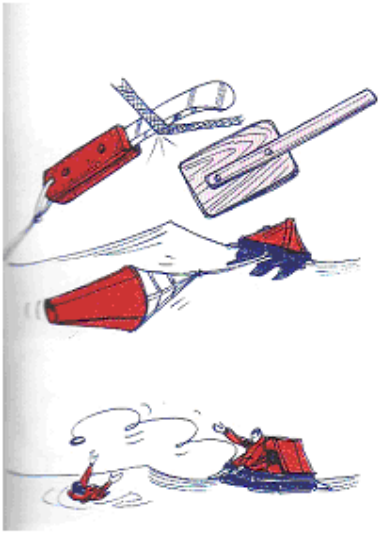

PTT: Push-To-Talk activates transmitter while switch is depressed. When switch is released, radio returns to receive mode automatically.
CHAN 16: Selects operation on marine channel 16 (Distress/Calling)
VOL ▲: Volume ▲ increases audio output level to maximum,
VOL▼: Volume ▼ decreases audio output level
ON/OFF: Press for one (1) second to turn ON. Press again to turn OFF.
CHAN 6: Selects operation on marine channel 6 (Communications, USCG)
VOL
VOL
PUSH
PTT
TALK
PRESS AND HOLD BUTTON FOR 1 SEC.
ON OFF
CHAN 16
CHAN 6
MICROPHONE/SPEAKER
INSTRUCTIONS
1. ON– PRESS ON/OFF BUTTON FOR 1 SEC.
2. SELECT CHANNEL–
16 EMERGENCY USE ONLY
6 SHIP TO SHIP AND U.S.C.G.
LIGHT SHOWS CURRENT CHANNEL
3. TRANSMIT– PRESS PUSH TO TALK (PTT) BUTTON AND SPEAK INTO MIC
4. RECEIVE– RELEASE PUSH TO TALK
5. VOLUME– ADJUST RECEIVE VOLUME
PRESS ▽ TO LOWER VOLUME
PRESS △ TO INCREASE VOLUME
6. OFF– PRESS ON/OFF BUTTON
CONSERVE BATTERY WHENEVER POSSIBLE
SEE BACK FOR OTHER INSTRUCTIONS

Fig. 11.8 2 Way VHF Radio ACR Electronics

Liferaft equipment



Safety knife

Usually found in small sheath by the entrance.Use to cut painter as close to the boat as possible, the line may be useful later.

Paddles

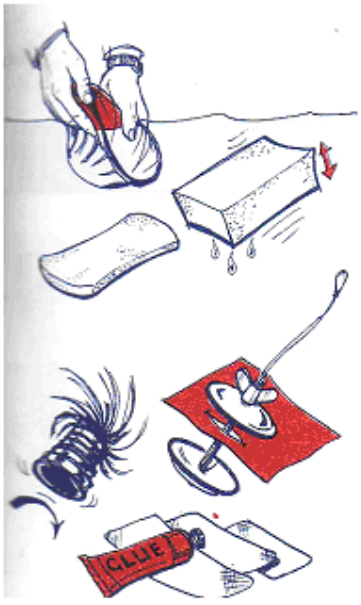
Essential for moving clear of a ship and very useful for manoeuvering ti pick up survivors from the water.

Sea anchor

Deploy immediately you are clear of the stricken vessel. It increases stability and reduce drift. Can be retrieved if progress to leeward is desirable.

Rescue quoit

Line 30 meters



Bailer

In smaller raft it is often no better that a shower cap. Boots are more effective but are a last resort as you will suffer heat loss if they are removed. It's extremely difficult to bail with the doorway closed, a dinghy stirrup pump is very effective.

Sponge (2)

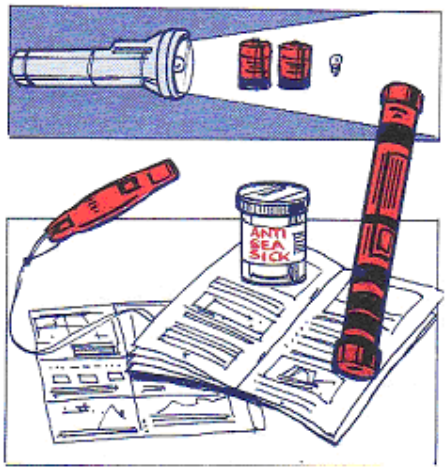
Use one to help dry out the raft, the other should be kept uncontaminated and used to collect drinking water by wiping condensation from inside the raft canopy.

Leak stoppers (set)

These rubber threaded bungs are surprisinghly effective for plugging air holes in sponsons.

Repair kit

You need a perfectly calm dry day before you can use this as you need to deflate the tube and dry it before applying the patch.



Torch

Essential if there are casualties and for repairs or signaling after dark.

Signal card

Will help you to understand communications from rescuers

Instruction leaflet

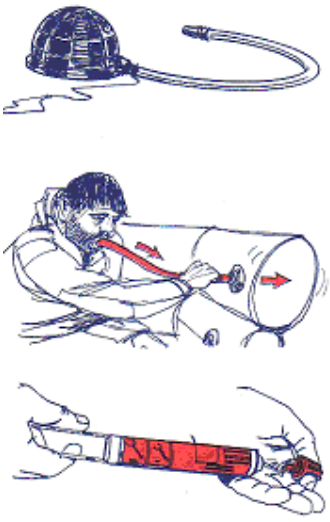
Information varies tremendously from raft to raft. Essentialy a drill prompt sheet.

Anti-seasick tablets

Should be issued as soon as possible

Whistle

More effective than shouting



Pump

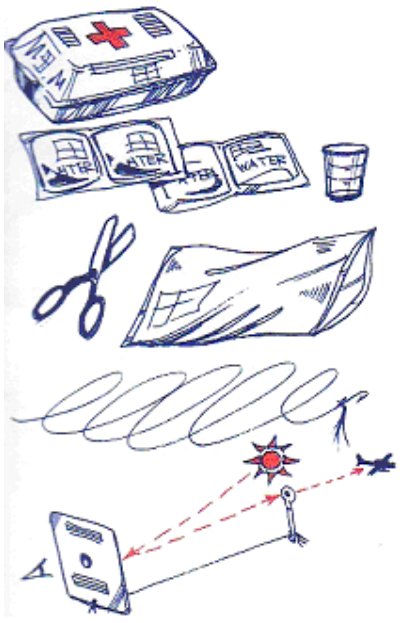
Inflating the floor is a long and hard job but worth doing for extra insulation. Avoid pumping water into the floor.

Keep teh tubes fully inflated. There is always some air through pressure release valves, punctures,daily expansion and contraction of air and buffeting by waves.

Tie the pump in. Lose it and you will need to keep the tubes topped up by month.

Flares

Probably one of the most important pieces of the equipment on the liferaft. Make sure you are familiar with the trigger methods amd use of different types. Keep them dry and do not use unless you have to.



First aid

Water: only half a litre per person in sachets.Supplemen this in the grab bag.

Drinking cup

Scissors

Plastic bag

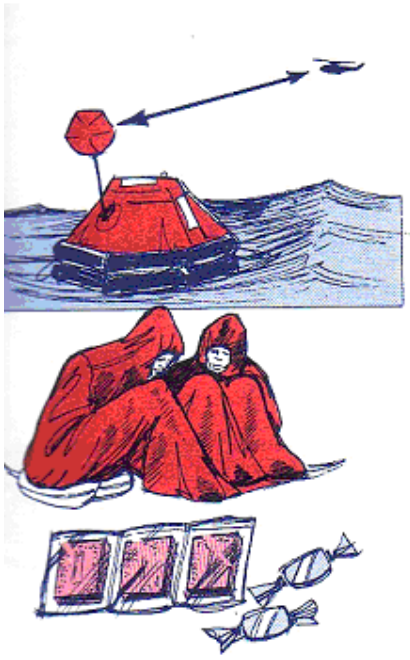
Use as sick bag, for protectin burns or injuries, and keeping things dry

Fishing kit

You must have extra water to aid digestion of fish otherwise you may be worse off. It is possible to obtain water by sucking fluids from the bones

Heliograph (signalling mirror)

You can also use an ordinary mirror or piece of shiny metal



Radar reflector

Fitted under a net or on telescopic pole

TPA

Thermal protective aids are good for reducing heat loss

Food

Type varies with the manufecturer, 10.000 KJoules per person

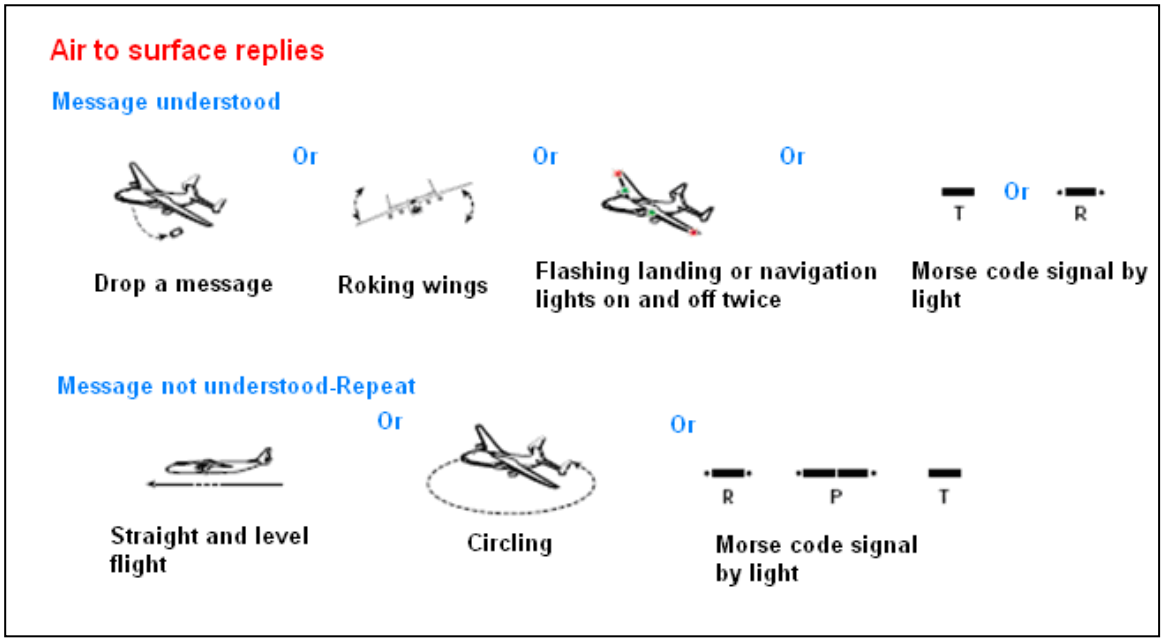
12. Methods of helicopter rescue

12.1 Communicating with the helicopter

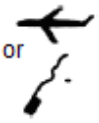
Surface-to-air visual signals

Communication from surface craft or survivors to an aircraft

Use International Code of Signals or plain language by use of a torch, signalling lamps or signal flags	or	Use the following surface-to-air visual signals by displaying the appropriate signal on the deck or on the ground
Message		International Code of Signals
Require assistance		V
Require medical assistance		W
NO or Negative		N
YES or afirmative		C



Signals to survivors

Procedures performed by an aircraft		Signification
Drop a message or 	Drop communications equipment suitable for establishing direct contact	The aircraft wishes to inform or instruct survivors

Signals used by survivors in response to a message dropped by an aircraft		Signification
Flash Morse Code signal "T" or "R" by light or	Use any other suitable signal	Dropped messages is understood by the survivors
Flash Morse Code signal "RPT" by light		Dropped messages is not understood by the survivors

In the event of a helicopter rescue situation the following points should be noted and followed:

- All operations will be directed by the crew of the Helicopter – follow all instructions they issue.
- Do not be distracted by the noise of the helicopter overhead, it may be necessary to have a crewmember positioned inside the boat to maintain radio communications with the helicopter due to the excessive noise on the outside decks.
- Prepare well in advance of the arrival of the helicopter; ensure crew are well briefed on correct procedures.
- Clear all obstructions on deck prior to its arrival ensure there are no items of loose or moveable gear on deck.
- The pilot will give specific instructions regarding course and direction he may wish you to steer, generally boats will maintain a course to give the wind at 30 degree to the port bow, and the preferred area to conduct winching operations is normally the port quarter. This affords the Pilot visual contact with both the boat and his winch man.
- Due to the risk of static build up from a hovering helicopter, follow the pilots instructions exactly with regard to earthing of a static discharge wire prior to placing the winch man on board, generally the wire is dropped into the sea to discharge static, prior to the commencing the operation.
- Under no circumstances should the winch line made fast at any time to the boat.
- On arrival of the winch man on board, he will assume command of all subsequent operations - follow his instructions at all times.

- Do not fire parachute flares when a helicopter is operating in the vicinity.

12.2 Evacuation from ship and survival craft
12.3 Helicopter pick-up

Potential survivors should be aware that, in most cases, the helicopter will first mark the location of the survivor. The pilot will fly the helicopter directly over the survivor and then fly it away from the survivor's position. At this time one to three marine markers (flares) or electric sea marker lights will be dropped prior to the start of the rescue pattern. The survivor should take caution not to touch the markers, as they can be dangerous. A naval helicopter assigned to operate as a rescue vehicle over water will have a rescue swimmer as a crewman. When the rescue swimmer is deployed, the survivor should remain in the life raft and await instruction from the swimmer.

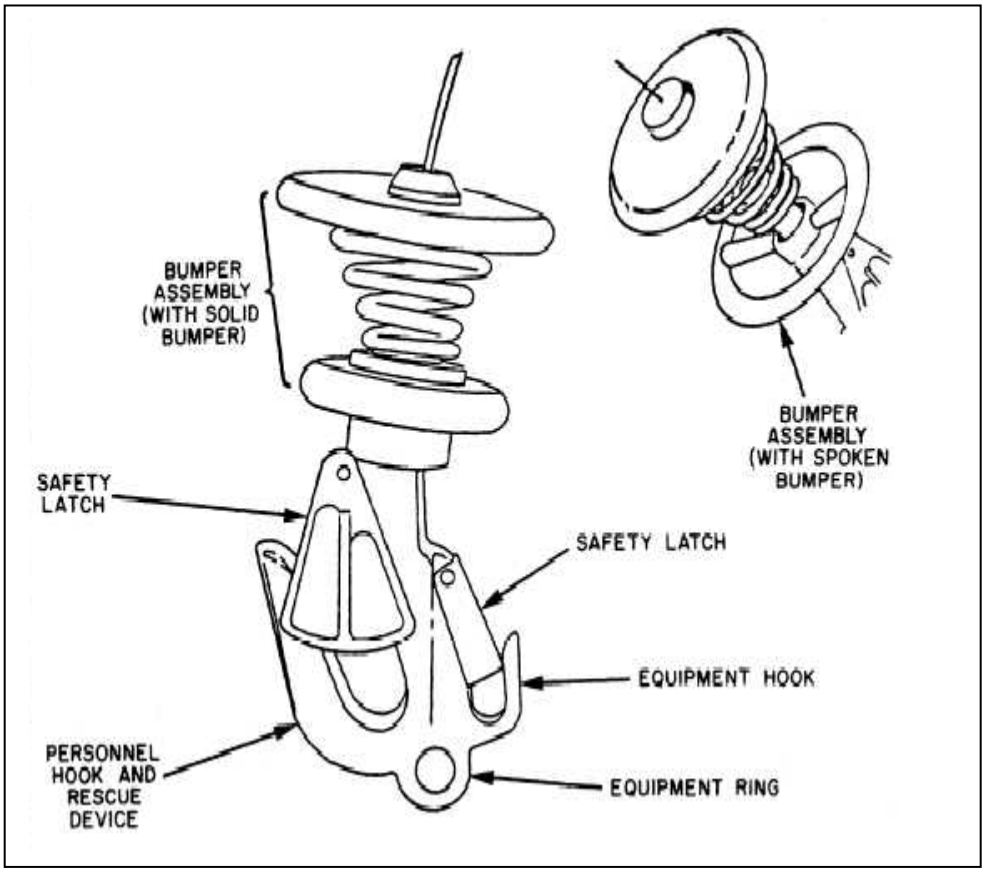


Fig. 12.1 Rescue hook

Rescue Hook

The rescue hook is the primary rescue device. All other rescue devices can only be used with the double rescue hook. In accordance with *Aviation Crew Systems Rescue and Survival Equipment,* NAVAIR13-1-6.5, the large hook, rated at 3000 pounds, shall be the only hook used to hoist personnel; the small hook, rated at 1000 pounds, is to be used only for lightweight items such as mail.

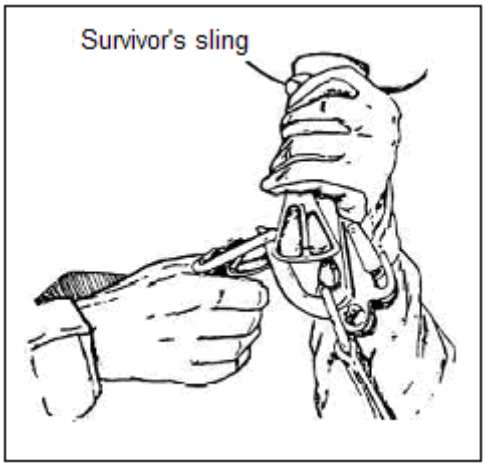


Fig.12.2 Attaching the rescue hook to the gated D-ring

Hoisting personnel by the equipment ring or small hook can lead to failure of the ring or hook and can result in injury or death of hoisted personnel. When wet and cold, an individual may have difficulty handling the latch on the rescue hook. However, by pushing down on the latch with the gated D-ring, you will force the latch open on either the hook or the gated D-ring.

Rescue Swimmer's Harness

During swimmer assisted rescues, the swimmer's harness may be used to attach the survivor to the hoist cable. When the rescue swimmer's harness is selected as the rescue lifting device, the rescue swimmer uses the following procedure:

1. He approaches the survivor from the rear and pulls the chest strap from the pocket of the rescue harness.

NOTE: When connecting to a survivor, he ensures that the chest strap on the survivor is loosened slightly to avoid injury. If the survivor is wearing an integrated torso harness, he uses extreme caution to ensure that the gated D-rings are not disconnected before hoisting.

2. Connects the gated D-ring of the rescue swimmers harness to the survivors lifting device. The connection of the survivor's lifting device to the rescue hook will negate the survivor's quick release feature of the swimmer's harness.

3. Signals the aircraft "ready for pickup." When the rescue hook is lowered in the water, connects the lifting V-ring of the rescue swimmer's harness to the large rescue hook.

4. Signals the aircraft “ready for hoist.”

NOTE: If the survivor is wearing an integrated torso harness, the swimmer ensures that the gated D-rings are not disconnected before hoisting. Upon reaching the aircraft door opening and while bringing in the survivor, he ensures that the gated D-rings do not twist and inadvertently disconnect.

5. Upon clearing the water, he places his arms and legs around the survivor.

6. The rescue swimmer and survivor are hoisted up to the helicopter. After reaching the helicopter, the rescue swimmer assists the survivor into the helicopter.

Rescue Strop (Unassisted Rescue)

The rescue strop (sometimes called the horse collar or rescue sling) is lowered attached to the rescue hook. The following is a step-by-step procedure for the survivor to don the strop and attach the rescue hoist:

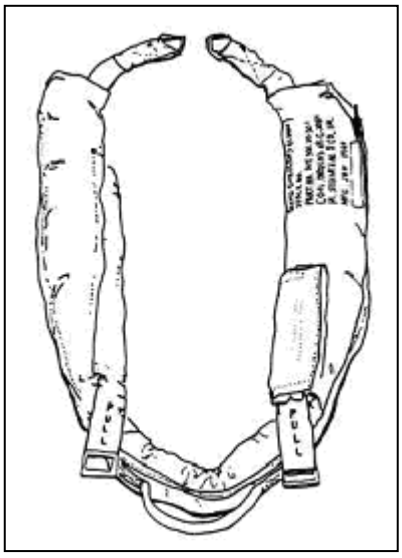


Fig. 12.3 Rescue strop (horse collar)

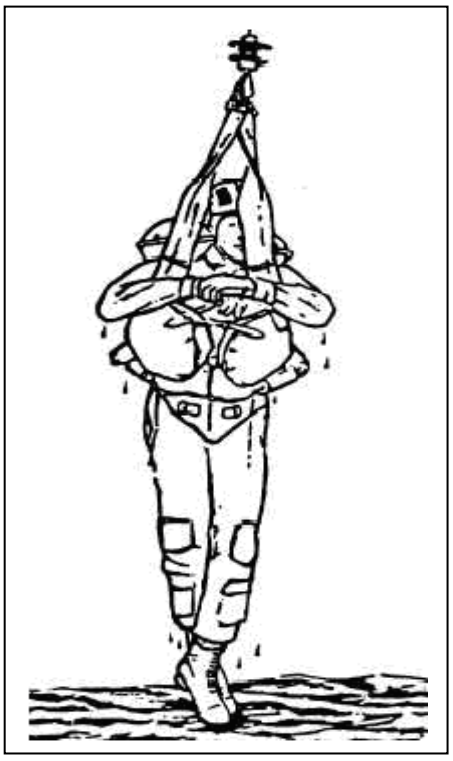


Fig.12.4 Hoisting the survivor’s sling

1. Stand by as the rescue device is lowered.

W A R N I N G

Do not touch the rescue device until after the hook makes contact with the water.

This prevents any electrical shock that may occur because of static electricity build up in the rescue device.

2. Swim to the rescue device. Grasp the free end of the rescue strop with your right hand and rotate your body clockwise until the rescue strop is wrapped around your body.

3. Attach the V-ring on the strop to the rescue hook.

4. Grasp the two pull tabs of the retainer straps and pull the straps out. Attach the quick-ejector snap hook to the V-ring and pull the strop tightly across your chest.

5. Ensure that the rescue strop is above the LPA/LPU waist lobes and high on your back. Give a thumbs-up signal to the hoist operator. Wrap your arms around the collar and keep your head down.

6. Upon clearing the water, cross your feet and remain in this position until you are inside the helicopter.

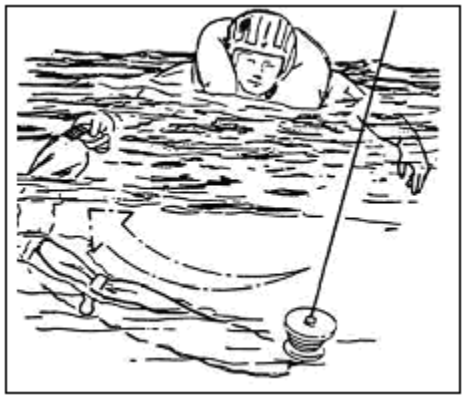


Fig. 12.5 Grasping the rescue strop

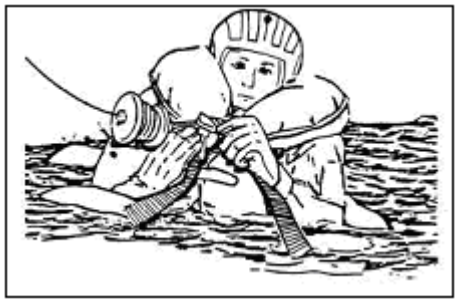


Fig. 12.6 Attaching the V-ring

Rescue Seat

The rescue seat can be used to lower and hoist personnel performing rescue operations from a helicopter over land or water. The rescue seat is designed to accommodate one survivor at a time. It is a buoyant aluminum device consisting of a hollow flotation chamber, a three-pronged seat, and a safety strap.

W A R N I NG

Failure to assume proper position on rescue seat could result in serious injury if hard contact is made with aircraft during hoist operation

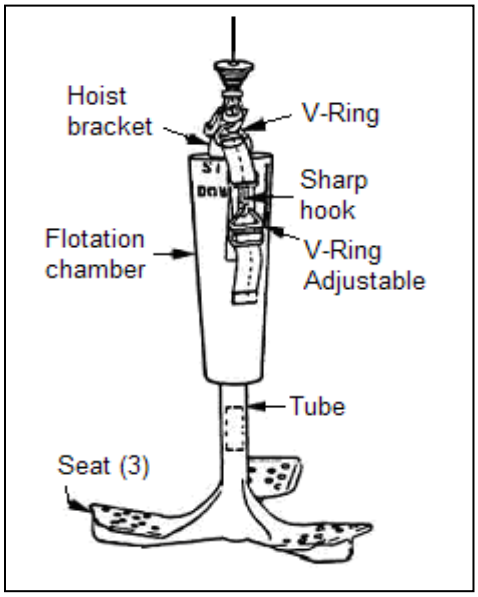


Fig. 12.6 Rescue Seat

ATTACHMENT PROCEDURE

The following is an attachment sequence for the rescue seat:

1. Swim to the rescue seat. Draw it to you and position one of the three flukes of the seat between your legs.
2. Disconnect the snap hook of the safety strap from the V-ring, pull the safety strap free, pass it under your arm, around your back, and under the other arm; then reconnect the V-ring to the snap hook and tighten the strap.
3. Give a thumbs-up hand signal to the hoist operator, put your head down to the left, and wrap your arms around the rescue seat. Upon clearing the water, cross your legs.

RESCUE SEAT OPERATIONAL DIFFICULTIES

Ensure that the safety strap is on and that you hold tightly to the flotation chamber. Do not lean back; it will cause the rescue seat to swing and tilt away from the rescue hook.

The survivor must not attempt to get off the rescue seat until directed by the crewman.

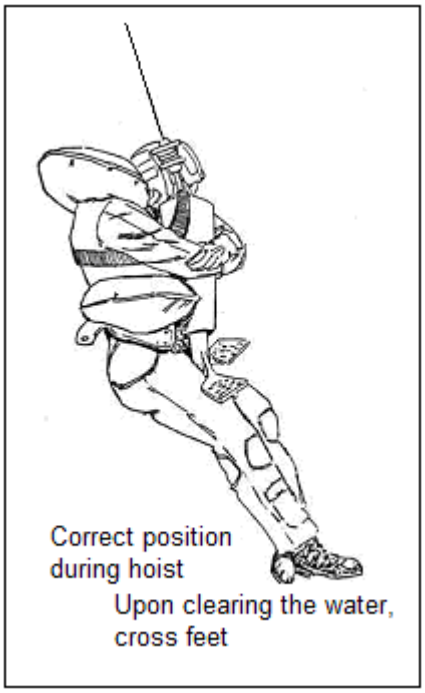


Fig. 12.7 Rescue seat maritime rescue procedure

Rescue Net

The rescue net is a simple and safe rescue device that can be used to hoist two survivors into a helicopter. It is designed for multiple rescue scenarios or for rescuing survivors who are unfamiliar with other rescue devices, such as the rescue strop or rescue seat. A lifting ring for hoisting is located at the top or upper portion of the net, along with locking support rods.

These rods incorporate sliding sleeves to prevent the net from collapsing while it is occupied.

At the front of the net are two additional support rods that can be disconnected from the top section when it is stored. When in use, the rescue net tilts away from its open side. This design helps prevent survivors from falling out.

The following is a step-by-step procedure for the survivor to safely board the rescue net:

1. When the net enters the water, swim to the net and position the net with its opening directly in front of you. Grasp each of the lower support rib floats.
2. Pull yourself into the net and turn so you are facing the opening.
3. Move all the way to the back of the net with your back resting against the rear of the net and your arms and legs completely inside. Give a thumbs-up hand signal to the hoist operator and maintain a secure handhold during the hoist.

The survivor must not attempt to get out of the rescue net until directed by the crewman.

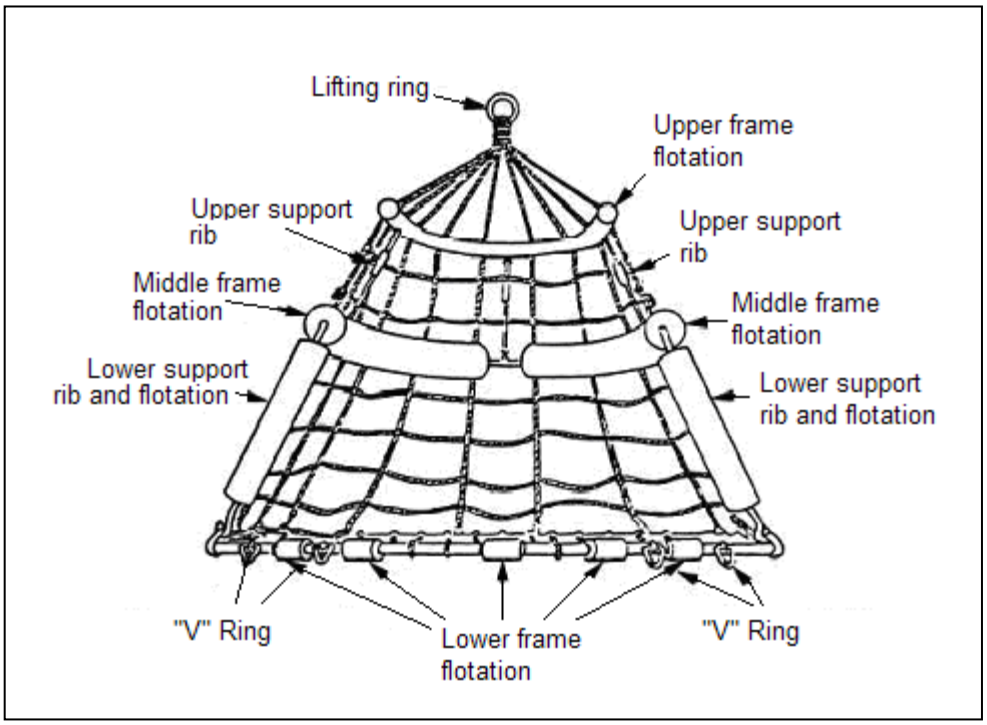


Fig. 12.8 Rescue net

13.Hypothermia

Hypothermia is the term given to the condition when deep body temperature is lowered to less than 35 degrees C (95 degrees F) when normal body function would be impaired. Loss of life may occur when deep body temperature falls below 30 degrees C (86 degrees F).

In a cold environment, body heat production will automatically increase in an effort to balance heat loss. However, if the rate of heat loss exceeds the rate of heat production, then the body temperature must fall. The rate of heat loss is many times greater in water than in air.

The rate of heat loss will vary depending on the difference in the temperature between the body and the water. In tropical water hypothermia can still occur but is likely to take far longer than in colder water, where death by hypothermia can occur in less than 1 hour. In addition, death by drowning is a frequent consequence of weakness caused by hypothermia. Crewmembers should be aware that almost all seas in the world are at a temperature which can be classed as a cold environment.

Hypothermia should always be suspected in every individual rescued at sea.

There are three stages of uncomplicated hypothermia:

- excitation - indicated by marked shivering, confusion and disorientation
- adynamic - indicated by amnesia, slowing of the heart and possible abnormal rhythms
- torpor.

Water Temperature		Expected Time Before Exhaustion or Unconsciousness	Expected Time of Survival
(°F)	(°C)		
32.5°	0.3°	< 15 minutes	45 minutes
32.5–40°	0.3–4.4°	15 – 30 minutes	30 – 90 minutes
40–50°	3.3–10°	30 – 60 minutes	1 – 3 hours
50–60°	10–15.6°	1 – 2 hours	1 – 6 hours
60–70°	15.6–21.1°	2 – 7 hours	2 – 40 hours
70–80°	21.1–26.7°	3 – 12 hours	3 hours – indefinite
> 80°	> 26.7°	Indefinite	Indefinite

The torpor stage may terminate in a comatose state, which can be difficult to distinguish from death. The casualty is unconscious, there are no reflexes and the pupils are dilated. The respiratory rate is very slow with only two or three movements a minute, the pulse is imperceptible and heart sounds cannot be heard, even with a stethoscope.

The treatment for hypothermia will of course depend on both the condition of the survivor and the facilities available. Generally, survivors who are rational and capable of recounting their experiences, although shivering dramatically, merely require removal of all wet clothes and replacement with dry clothes or blankets. Hot sweet drinks and rest in a warm environment not exceeding normal room temperature is also recommended. However it should always be remembered that even conscious survivors can collapse and become unconscious shortly after rescue, they should therefore be laid down and not be left alone. Alcohol should never be administered.

In more serious cases, where the survivor is not shivering but is semi-conscious, unconscious or apparently dead, slow re-warming is essential. The following measures will also be necessary to preserve life.

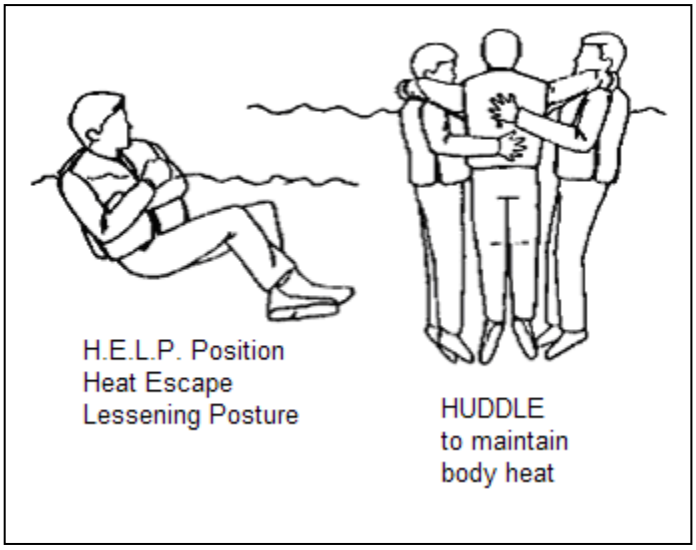
- Upon rescue check the survivors breathing and listen for heart sounds. If the surveyor is not breathing, ensure the airway is clear and start artificial respiration immediately. Attempts at resuscitation should be continued until medical advice can be obtained, or for at least 30 minutes.
- Prevent further heat loss due to evaporation or exposure to wind.
- Do not massage the limbs.
- Avoid all unnecessary handling, even the removal of wet clothing.
- Enclose the survivor in a plastic bag or blanket, or preferably both. The blankets should not be warmed and it is important that the head, but not the face, is well covered. The survivor should be placed in a room that is not too warm - 15/20 degrees C (59/70 degrees F).
- Never attempt to give any fluids by mouth to an unconscious casualty.
- If the survivor is breathing but unconscious, lay him in the unconscious position and when consciousness has been fully regained give a warm sweet drink.
- Conscious survivors suffering from hypothermia should be laid on their side and whenever possible, in a slightly head down attitude.

Maximize your chances of surviving by:

- Wearing a personal flotation device (PFD)
- Adopting a survival position
- Keeping clothing on
- Getting as much of body out of the water as possible
- Remaining still and in place UNLESS a floating object, another person, or the shore is nearby
- Keeping a positive mental outlook (a will to survive really does matter)

Swimming isn't recommended unless there is little chance of being rescued and shore is less than a mile away. Putting on a PFD after falling into cold water is almost impossible – SO WEAR IT. If you find yourself in cold water without a

PFD and nothing to climb onto, tread water. Traditional drown-proofing by repeatedly lowering your head into the water and floating speeds up heat loss.



Preventing hypothermia

Clothing

Savvy outdoors enthusiasts know that insulating critical heat loss regions (head and neck, sides of chest, armpits, and groin) forestalls hypothermia, frostbite, or simple cold discomfort. Layering appropriate fabrics helps preserve body heat, also. No cotton. When wet it is worthless as an insulator and heavy.

1. "Wick, warmth, and weather." Wear a wicking fabric next to your skin, insulating layers of fleece or wool, then an outer layer made of windproof, watertight materials.
2. No cotton; seriously.

Clothing made of modern watertight materials like nylon and Gore-Tex are good for keeping warmth in and cold water out. However, they require carefully selected underclothing since the garments may not have built-in insulation. If flotation materials are not used, then wear a PFD in addition to watertight clothes.

Flotation

Wear a personal flotation device (PFD). For the greatest protection against hypothermia, insulate the critical regions of your body with specifically designed PFD. A vest PFD offers more protection than a collar-type, and will improve your chances of survival. Insulated flotation jackets protect more of your body than

vest or collar-type PFDs. A hood protects the head and neck area, and a removable seat panel reduces heat loss in the groin area.

Regardless of what you use to prevent hypothermia – life vest, float coat, industrial work suit, survival suit, or drysuit – flotation and insulation are important in increasing your survival time. PFDs designed to prevent hypothermia are recommended for anyone who spends time on or near cold water. To increase your visibility in the water, add reflective tape to your PFD. A strobe light, whistle, or emergency position indicating radio beacon (EPIRB) will increase your chance of being rescued.

Hypothermia symptoms

When you first fall into cold water you gasp (torso reflex). Next, your skin begins to cool, and your body constricts surface blood vessels to conserve heat for your vital organs. Blood pressure and heart rate increase. Muscles tense and shiver; this produces more body heat, but results in a loss of dexterity and motor control. As your body's core temperature drops further, blood pressure, pulse, and respiration rates all decrease.

As conditions worsen, your mental attitude and level of consciousness change. Resisting help and acting irrational or confused are common indicators of hypothermia. As your core temperature drops dangerously low, you become semiconscious, then unconscious. Stress, shock, and low core temperatures may cause cardiac and respiratory failure.

Hypothermia sneaks up on you, so you probably aren't the best judge of whether or not you are hypothermic.

Signs that a person is nearing a hypothermic state include shivering, poor coordination, and mental sluggishness. As hypothermia progresses, shivering ceases, coordination is severely impaired, and confusion is coupled with incoherence and irrationality. Severely hypothermic people have icy skin. Extreme lethargy merges with unconsciousness and they might appear dead.

Since each individual reacts differently, the severity of hypothermia is best measured by taking a core temperature reading using a rectal thermometer. Oral measurements do not accurately measure changes in core temperature.

Treating hypothermia

First aid goals include:

- preventing further heat loss,
- re-warming the victim,
- quickly getting professional medical help as needed.

Minimize the victim's physical exertion when removing her or him from cold water. Rescuers may have to enter the water to get the victim. Once out of the

water, gently remove wet clothing and cover the person with dry clothing or blankets. Protect the victim from wind, especially around the head and **neck.**

Move them to a warm environment if possible and avoid re-exposure to the cold. Warm compresses and warm (not hot) liquids that are non-alcoholic and non-caffeinated also help to restore heat.

Other recommendations include applying hot water bottles (maximum temperature of 115° F (46° C) or hot, damp cloths to the victim's head, neck, trunk, and groin (change the water periodically to ensure a constant temperature). Exhale into the victim's face as s/he inhales. Immerse the victim's trunk but keep the arms and legs out of a warm bath (maximum temperature of 115° F (46° C).

If you are helping a hypothermic person, be gentle; internal organs are sensitive to physical shocks. The victim should remain as inactive as possible so blood from their cold extremities won't reach their core too quickly. A cold heart is particularly susceptible to ventricular fibrillation.

During all first aid efforts, watch for changes in the victim's temperature and vital signs. "After drop" is a danger when re-warming hypothermia victims because cold blood in the extremities returns to the body core, lowering the core temperature further.

Hypothermia victims with moderate to critical symptoms should see a medical professional as soon as possible.

Symptoms	Treatment
Mild Case: Body temperature is 97 - 93° F (36.1 - 33.9° C)	
• Shivering • Cold hands and feet • Still alert and able to help self • Numbness in limbs, loss of dexterity, clumsiness • Pain from cold	• Prevent further heat loss. • Allow body to re-warm itself. • Warm, sweet drinks - no alcohol. • Apply gentle heat source. • Help victim exercise. • Keep victim warm for several hours, with head and neck covered.
Moderate Case: Body temperature is 93 – 90° F (33.9 – 32.2° C)	
• Shivering may decrease or stop	• Same as above, EXCEPT: • Limit exercise. • Offer warm, sweet liquids only if victim is fully conscious, begins to re-warm, and is able to swallow – no alcohol.
Severe Case: Body temperature is 90 – 82° F (32.2 – 27.8° C)	
• Shivering decreases or stops • Confusion, abnormal	• Obtain medical advice/help as soon as possible. • Avoid jarring victim - rough handling may

Symptoms	Treatment
behavior, i.e, loss of reasoning and recall • Clumsiness • Slurred speech • Denies problem, may resist help • Semiconscious or unconscious • Muscular rigidity increases	cause cardiac arrest or ventricular fibrillation of heart. • No food or drink - no alcohol. • Ignore pleas of "Leave me alone." Victim is in serious trouble. • Treat as for shock – lay down in bunk, wedge in place, elevate feet. • Apply external mild heat to head, neck, chest, and groin - keep temperature from dropping, while avoiding too rapid a temperature rise. • Transport to hospital.

Critical Case: Body temperature is less than 82° (< 27.8° C)

	• Assume patient is revivable; don't give up. • Handle with extreme care. • Tilt the head back to open the airway – look, listen and feel for breathing and pulse for one to two minutes.
• Unconscious, may appear dead • Little or no apparent breathing • Pulse slow and weak, or no pulse found • Skin cold, may be bluish-gray color • Pupils may be dilated • Rigid body	• If there is breathing or pulse no matter how faint or slow, do not give CPR, but keep a close watch for changes in vital signs. • If no breathing or pulse is detected for one to two minutes, begin CPR immediately. Medical help is imperative – hospitalization is needed. • Stabilize temperature with external heat sources, and/or use rescuer's breath exhaled in victim's face in unison with victim's breathing.

14. Radio Equipment

14.1 Two-way VHF radiotelephone apparatus

14.1.1 Recommendation on performance standards for on-scene (aeronautical) portable two-way VHF radiotelephone apparatus

(Annex 5 Resolution MSC 80 (70) Dec 1998)

General

The equipment should be portable and capable of being used for on-scene communication between a ship and aircraft.

The equipment should comprise at least:

- an integral transmitter/receiver including antenna and battery;
- an integral control unit including a press-to-transmit switch; and
- a microphone and loudspeaker

The equipment should:

- be capable of being operated by unskilled personnel;
- withstand drops on to a hard surface from a height of 1 m;
- be of small size and light weight;
- be capable of operating in the ambient noise level likely to be encountered during SAR operations;
- have provisions for the use of external microphone/headset; and
- have a colour which distinguishes it from the portable equipment specified in resolution A.809(19).

Class of emission, frequency bands and channels

The two way radiotelephone should be amplitude-modulated and capable of operation on the frequencies 121.5 MHz and 123.1 MHz.

Control and Indicators

An on/off switch should be provided with a positive visual indication that the radiotelephone is switched on.

The receiver should be provided with a manual volume control by which the audio output may be varied.

Frequency selection should be easily performed and the frequencies should be clearly discernible.

Permissible warming-up period

The equipment should be operational within 5 s of switching on.

Safety precautions

The equipment should not be damaged by the effects of open-circuiting or short-circuiting the antenna.

Transmitter power

The carrier power should be between 50 mW and **1**.5 W.

Receiver output

The audio output should be sufficient to be heard in the ambient noise level likely to be encountered during SAR operations.

In the transmit condition, the output of the receiver should be muted.

Power supply

The source of energy should be a primary battery integrated in the equipment and may be replaceable by the user. In addition, provision may be made to operate the equipment using an external source of electrical energy.

The primary battery should have sufficient capacity to ensure 8-hour operation at its highest rated power with a duty cycle of 1:9. This duty cycle is defined as 6-second transmission, 6-second reception above squelch opening level and 48-second reception below squelch opening level.

Primary batteries should have a shelf life of at least 2 years

Labelling

In addition to the general requirements specified in resolution A.694(17), the following should be clearly indicated on the exterior of the equipment:

- brief operating instructions;
- expiry date for the primary batteries; and
- the following text: "only for emergency communications with aircraft.

MCA : Radio equipment and searchlights for survival craft, Chapter 12

Siting of equipment

The equipment should be kept in a suitable place ready to be moved into a survival craft in case of emergency. Where lifeboats using ‘freefall launching’ techniques are carried, and not provided with a fixed VHF installations, each should be provided with appropriate means to securely retain the portable equipment during launching. In ships where the disposition of superstructures or deck houses is such as to involve substantial fore and aft separation, all portable radio apparatus should not be located in the same area of superstructure or in the same deck house. Where the equipment is additionally used to comply with the appropriate 1999 LSA Regulations for ‘On-board communications and alarm systems’ or for any other purpose, sufficient sealed primary batteries should be kept at a suitable place ready to be moved into a survival craft in case of emergency, ideally with any other items of equipment that may be required in such an eventuality.

Power supply

The source of energy should be integrated in the equipment although provision may be made to operate the equipment using an external source of electrical energy. The source of electrical energy should have sufficient

capacity to ensure at least 8 hour operation at the highest rated power of the equipment with a duty cycle of 1:9. This duty cycle is defined as 6 seconds transmission, 6 seconds reception above squelch opening level and 48 seconds below squelch opening level. The source of energy should comply with one of the following:

(a) A sealed primary battery which should be of a type which will not emit substances which may be injurious to personnel, or damaging to the equipment or fabric of the survival craft. This requirement should be met whether the power source is in a stored condition or normal use. The battery should be clearly marked with the shelf life whose expiry should not be less than 2 years from the date of survey. The battery should have sufficient capacity so that routine testing of 2 minutes once per week should not reduce its capacity below that needed to conform to the operational requirements recommended above.

OR

(b) A re-chargeable battery which should not emit substances which may in any way be injurious to personnel, or damaging to the equipment or fabric of a survival craft. This requirement should be met whether the power source is in a stored condition or in normal use. Batteries that have been in service for more than two years should not be used for this purpose. The battery should be capable of fulfilling the capacity requirements recommended above at all times. A means of automatically charging such batteries should be provided which should be capable of recharging them to minimum capacity requirements within 10 hours from the ship's main source of electrical power.

Equipment for which the source or energy is intended to be user-replaceable should be provided with a dedicated primary battery for use in the event of a distress situation. This battery should be equipped with a non-replaceable seal to indicate that it has not been used.

Equipment for which the source or energy is intended to be non-user-replaceable should be provided with a primary battery. The portable two-way radiotelephone equipment should be fitted with a non-replaceable seal to indicate that it has not been used.

Primary batteries should have a shelf life of at least 2 years, and if identified to be user replaceable should be either or a highly visible yellow/orange colour or marked with a surrounding yellow/orange marking strip.

Batteries not intended for use in the event of a distress should be of a colour or marking such that they cannot be confused with batteries intended for such use.

Batteries should be disposed of strictly in accordance with manufacturer's instructions.

14.1.2 Description and technical details of two-ways VHF

- Transmits and receives on VHF Channels 16 and 6
- Capable of withstanding total immersion to 3.3 m
- Floats to prevent being lost overboard like other radios
- Can be stored in a survival craft for up to 5 years
- Easily replaceable "push/twist/lock" battery; 5 year replacement

Specification for ACR SR-102 :

Operating frequency: Channel 16 Channel 6	 156.800 MHz, Distress Calling 156.300 MHz, Communications/USCG
• **Power output (ERP):**	500mW ± 2.5dB
Frequency control:	Quartz crystal (±.001%)
Modulation type:	Phase
Max. modulation:	± 5kHz
Audio width:	300/2500Hz
Sensitivity (12dB SINAD):	1.0 µV
Audio output:	300 mW
Battery type:	Primary: lithium
Storage life:	10 years
Operating life under typical duty:	8 hours @ -20°C
Temperature Range:	–20°C to +60°C
Altitude:	0 to 12000 m
Water resistance:	3m depth, max up to 5 minutes
Dimensions (less antenna):	193 × 99 × 43 mm
Antenna:	292 mm
Weight (includes battery):	0.5 kg

The 16/6 Survival Craft Portable Two-Way VHF Radiotelephone is intended to be used for on-scene emergency communications between survival craft and ship, and survival craft and rescue units. The radio is equipped with a 5 year lithium survival battery pack which is user replaceable. With the lithium battery pack installed, the unit meets all IMO, SOLAS and FCC requirements for survival craft two-way VHF transceivers.

The Survival Radio and its protective cover shall be packed with the ship's survival craft or in a survival suit. When not packed with a life raft, the radiotelephone should be stored in an accessible place, as close to the survival craft as possible.

All radio controls are flat-panel, push-types located on the front surface of the radio.

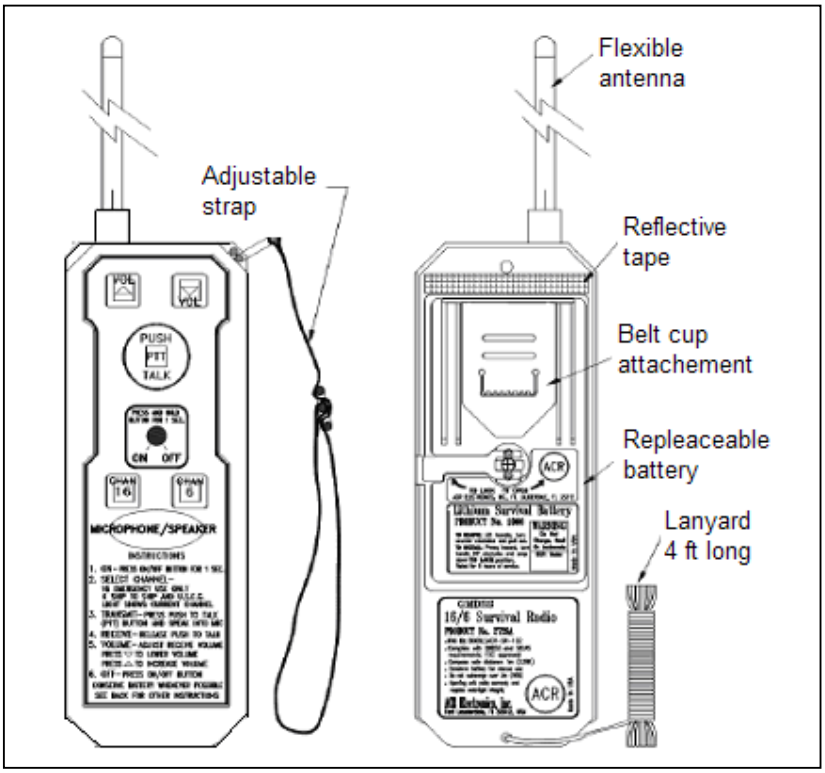


Fig.14-1 SR-102 Main feature

Operating indicators

CHAN 16 : The push switch includes a **RED** light which will be illuminated when the radio is ON and Channel 16 is selected.
CHAN 6 : The push switch includes a **GREEN** light which will be illuminated when the radio is ON and Channel 6 is selected.
VOL ▲ ▼ : Both of these push switches light up **YELLOW** when the **PTT** switch is depressed - indicates that radio is transmitting.
PTT : The push switch blinks **YELLOW** at a slow rate to assist operator in locating the PTT switch in darkness.

CHANNEL 16 OPERATION (CHAN 16)

1. Remove control panel protective cover.
2. Strap the unit around operator's wrist, hand or glove.
3. Press ON/OFF button for one (1) second to turn ON the Survival Radio.
4. CHAN 16 button stays lit (red).
5. Listen for the tone and for the squelch action 3 seconds after activating the unit.
6. Press blinking PUSH TO TALK button to transmit.
7. Speak loudly and clearly into speaker area from a distance of approximately 3"to 6" (7.5 cm to 15 cm).
8. Both Volume indicators stay lit during transmission.
9. Release PUSH TO TALK button to listen.

10. Adjust Volume by pressing the respective buttons (Note: there are 4 preset volume settings from which to choose).
11. Keep transmissions to a minimum to conserve battery power.
12. Periodically verify that the CHAN 16 button is lit (red) to guard against accidental selection of channel 6.
13. Press ON/OFF button to turn unit off.

CHANNEL 6 OPERATION (CHAN 6)

1. Remove control panel protective cover.
2. Strap the unit around operator's wrist, hand or glove.
3. Press ON/OFF button for one (1) second to turn on the Survival Radio.
4. CHAN 16 button stays lit (red).
Y1-03-0079-1C 8
5. Listen for the tone and for the squelch action 3 seconds after activating the unit.
6. Press CHAN 6 button to select channel 6.
7. CHAN 6 button stays lit (green).
8. Adjust Volume by pressing the respective buttons (Note: there are 4 preset volume settings from which to choose).
9. Press blinking PUSH TO TALK button to transmit.
10. Speak loudly and clearly into speaker area from a distance of approximately 3"—6" (7.5 cm to 15 cm).
11. Both Volume indicators stay lit during transmission.
12. Release PUSH TO TALK button to listen.
13. Keep transmissions to a minimum to conserve battery power.
14. Press ON/OFF button to turn unit off.

BATTERY SAVE FEATURE

To conserve battery life, the unit will automatically shut-off following a period of approximately 20- 30 minutes of idle radio activity.

SENDING DISTRESS COMMUNICATIONS

The following are a set of observations intended to help the user maximize his success during the course of a rescue where two-way communication is possible.

1. Transmit only when the channel is clear of activity, or between other stations' transmissions during a distress.

2. Use the world recognized expression M'AIDER or MAYDAY to call for help. Note that MAYDAY is commonly pronounced as it is read in English, when utilized in English speaking countries. To improve the chances of being understood internationally, it is best to pronounce the above expression two ways:

a. The internationally recognized way, *M'AIDER* (in French) pronounced phonetically as “mĕ - dĕ,” (see any French language instruction book for further details) and,

b. The commonly used pronunciation in English speaking countries MAYDAY pronounced phonetically as “mā - dā.”

To prevent the distress signal from being misunderstood, and to improve the intelligibility of the distress call, use the two pronunciations above when calling.

EXAMPLE: "M'AIDER MAYDAY M'AIDER THIS IS MARY JANE WXT599 WXT599 WXT599".

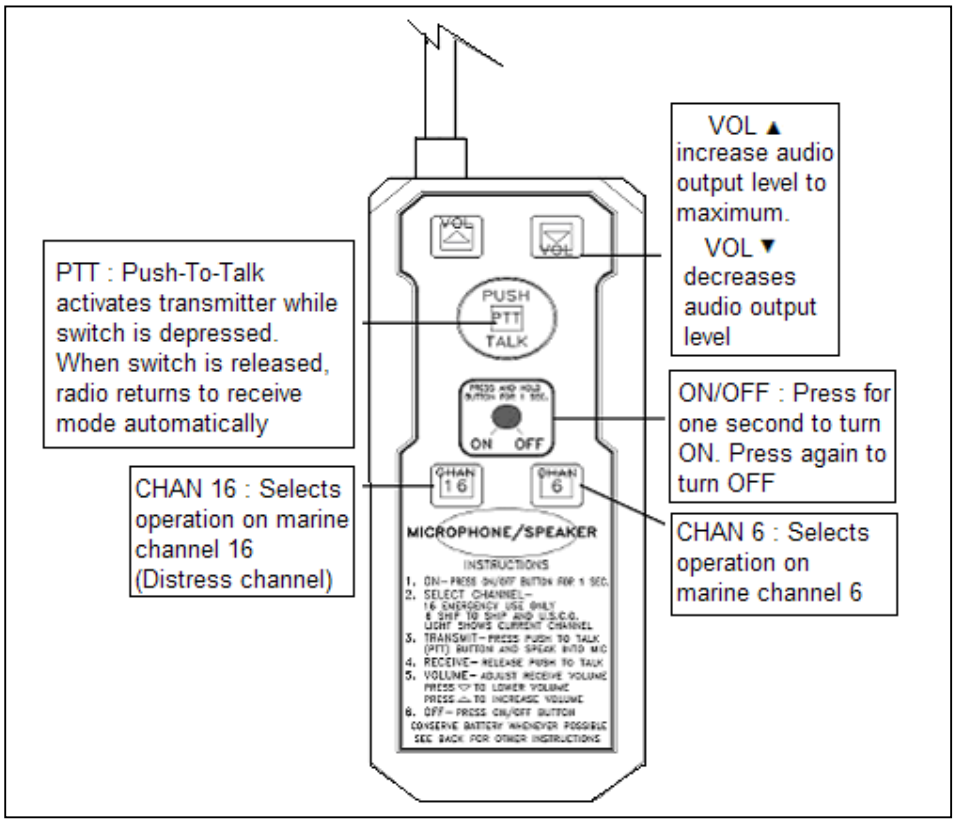

VOL ▲ increase audio output level to maximum.
VOL ▼ decreases audio output level
PTT : Push-To-Talk activates transmitter while switch is depressed. When switch is released, radio returns to receive mode automatically
ON/OFF : Press for one second to turn ON. Press again to turn OFF
CHAN 16 : Selects operation on marine channel 16 (Distress channel)
CHAN 6 : Selects operation on marine channel 6
PUSH PTT TALK
ON OFF
CHAN 16
CHAN 6
MICROPHONE/SPEAKER
INSTRUCTIONS

Fig. 14-2 Control panel

Always use the ICAO Convention (Convention on International Civil Aviation) recognized alphabet for spelling.

ICAO recognized alphabet:

A Alpha	N November
B Bravo	O Oscar
C Charlie	P Papa
D Delta	Q Quebec
E Echo	R Romeo
F Foxtrot	S Sierra
G Golf	T Tango
H Hotel	U Uniform
I India	V Victor
J Juliet	W Whiskey
K Kilo	X X-ray
L Lima	Y Yankee
M Mike	Z Zulu

EXAMPLE**:** "M'AIDER MAYDAY M'AIDER THIS IS MARY JANE Whiskey X-ray Tango 599 Whiskey X-ray Tango 599 Whiskey X-ray Tango 599"

To acknowledge that a transmission has been received and understood in its entirety, simply use the expression "R R R" spoken as "Romeo Romeo Romeo" ("R" stands for received). Note: some radio operators use the expression "Roger" instead of "Romeo".

The typical range for a transmitting radio held at about 1.2 meters (4.0 ft) above average water level is expected to equal 4.5 kilometers (2.8 statute miles). The receiving shipborne antenna can extend the range if it is mounted high. Airborne receivers greatly extend the above range (over 150 kilometers/100 miles for aircraft flying over 1500 meters/5000 ft).

Because of the above fact, and to maximize the range of the survival craft VHF radiotelephone, the unit should be held as high as possible without endangering the safety of the operator.

14.2 Emergency position-indicating radio beacons (EPIRBs)

14.2.1 Requirements for the carriage of EPIRBs

MCA : Radio equipment and searchlights for survival craft, Chapter 12

General requirements

The equipment should be clearly marked with the manufacturer's identity, type or model identification, serial number, brief operating instructions and the expiry date for the primary batteries used.

The minimum safe distance from the standard or magnetic steering compass at which the equipment may be installed should also be marked; where no marking exists surveyors should note the instructions provided in the MCA's publication ''Survey of Merchant Shipping Navigational Equipment Installations—Instructions for the Guidance of Surveyors'', when considering the arrangements for location.

The surveyor should ensure the identity of the beacon fitted to the ship correlates with the information held on the appropriate beacon register.

The arrangements made in individual ships should be determined to the satisfaction of the marine surveyor in consultation with the radio surveyor.

Performance standards

The EPIRB should conform with a performance standard adopted by the IMO through Resolution. If operating on 406 MHz the EPIRB should conform with:

12.3.2.1 if installed on or after 23 November 1996, Assembly Resolution A.810(19);

12.3.2.2 if installed before 23 November 1986, Assembly Resolution A.763(18); or

12.3.2.3 if installed before 4 November 1994, Assembly Resolution A.763(18), except that they need not be provided with the 121.5 MHz homing beacon required by 2.3.14 of part A thereof.

If operating on the INMARSAT system the EPIRB should conform with:

12.3.2.1 if installed on or after 23 November 1996, Assembly Resolution A.812(19); or

12.3.2.2 if installed before 23 November 1996, Assembly Resolution A.661(16).

Testing of equipment

Satellite EPIRBs are provided with a 'self-test' facility which a surveyor may wish to activate.

Should the beacon 'fail' the 'self-test' it must be withdrawn from service. The EPIRB should not be removed from its float-free arrangements other than by an appropriately qualified engineer.

Siting of equipment

The installed EPIRB should be located in such a position that:

- upon foundering, it will automatically float free from the ship without hindrance from any item of equipment or superstructure;
- objects, especially those within 1 metre of the antenna which cause a shadow sector or greater than 2 degrees, are likely to significantly degrade the antenna performance of the equipment; and
- it may be easily released manually and brought to the survival craft.

Surveyors should pay particular attention to requirement .1 and great care should be taken when assessing the appropriateness, or otherwise, of the location adopted. Under no circumstances should this requirement be compromised to fulfil any additional functions the EPIRB may be required to perform. Where this is not practicable using a single EPIRB, additional equipment should be provided.

Float free arrangements

The float free release and activation arrangements should comply with the performance standards adopted by the IMO through Assembly Resolution A.662(16).

The float free arrangements should carry a label indicating clearly the operating instructions for manual release.

The installed EPIRB should be capable of local manual activation (remote activation may also be provided from the navigating bridge) while the device is installed in the float-free mounting.

Any connection to the EPIRB, for example for the purpose of supply of data or power, should be corrosion resistant, protected against accidental activation and must not in any way inhibit the release of the beacon in times of emergency. Any hydrostatic release provided should be clearly marked with the date of expiry and tested in accordance with the manufacturer's instructions to ensure satisfactory operation.

14.2.2 General

EPIRBs (pronounced ee-pirbs), formally Emergency Position Indicating Radiobeacons, are devices that trasmit a digital signal on the international distress signal frequency 406 MHz. Designed to work with satellites, EPIRBs are detectable by COSPAS-SARSAT satellites, which orbit the poles, and by the GEOSAR system which consists of GOES weather satellites and other geostationary satellites.

There are two types of EPIRBs - Category I or Category II that are approved for use in the United States today. Both transmit only on 406 MHz.

In February of 2009, the FCC phased out the use of EPIRBs that transmitted on 121.5 MHz frequency (Class A, B, and S), and these devices may no longer be used, marketed or manufactured in the U.S. If you have one of these, please replace it with an approved 406 MHz device.
Category I EPIRBs float-free and are automatically activated by immersion in water, and they are detectable by satellite anywhere in the world. Category II EPIRBs are similar to Category I, except in most cases they are manually activated, however some models can be automatically activated.

EPIRBs use a special type of lithium battery designed for long-term, low-power consumption operation. The battery must be replaced by a dealer approved by the manufacturer during the specified time or it will not work properly. Also, consumers should be aware when ordering EPIRBs online, added shipping charges may apply for hazardous material. Some EPIRBs and PLBs are being manufactured that do not use hazardous material batteries.

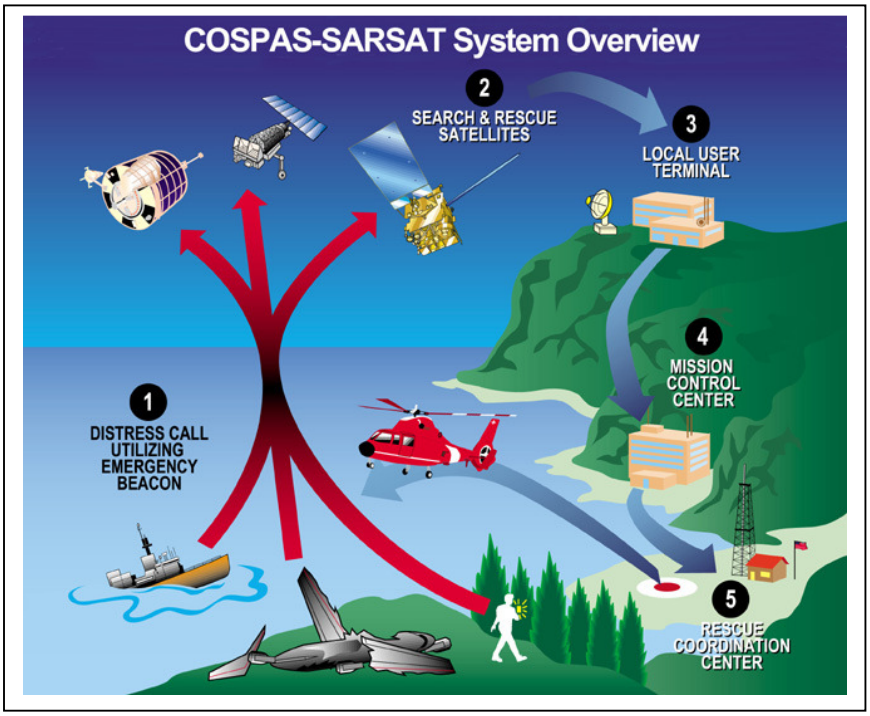
Category I EPIRBs float-free and are automatically activated by immersion in water, and they are detectable by satellite anywhere in the world.

Category II EPIRBs are similar to Category I, except in most cases they are manually activated, however some models can be automatically activated.
EPIRBs use a special type of lithium battery designed for long-term, low-power consumption operation. The battery must be replaced by a dealer approved by the manufacturer during the specified time or it will not work properly. Also, consumers should be aware when ordering EPIRBs online, added shipping charges may apply for hazardous material. Some EPIRBs and PLBs are being manufactured that do not use hazardous material batteries.

Proper registration of your 406 MHz satellite emergency position-indicating radio beacon (EPIRB) is intended to save your life, and is mandated by Federal Communications Commission (FCC) regulations.
The Coast Guard is enforcing this FCC registration rule.

According to the Coast Guard, "if the EPIRB is properly registered, [they] will be able to use the registration information to immediately begin action on the case. If the EPIRB is unregistered, a distress alert may take as much as two hours longer to reach the Coast Guard over the international satellite system. If an unregistered EPIRB transmission is abbreviated for any reason, the satellite will be unable to determine the EPIRB's location, and the Coast Guard will be unable to respond to the distress alert. Unregistered EPIRBs have needlessly cost the lives of several mariners since the satellite system became operational."

14.2.3 COSPAS-SARSAT EPIRBs



Compared with simple 121.5 MHz ELTs a 406,025-MHz or 406,028-MHz EPIRB provide for some advantages. COSPAS-SARSAT satellites for 406-MHz beacons compute and store the estimated position of the EPIRB when passing by. When reaching the next ground station these satellites forward the stored distress call with the estimated position. Since COSPAS-SARSAT satellites are of polar surrounding LEO type, they guarantee a global coverage. A 406 MHz EPIRB should be programmed with the owner's particulars like serial number, MMSI or call-sign. This allows SAR forces to *identify the disabled vessel.*

COSPAS/SARSAT satellite transponders are payloads on (e.g.) weather satellites owned by the USA, Russia, France and Canada. The principle of position estimation remains the same as with 121,5 MHz beacons, but COSPAS/SARSAT 406-MHz EPIRBs carry very stable oscillators so-called OCXOs (oven controlled crystal oscillators) or TCXO (temperature compensated crystal oscillators). They improve the Doppler measurent.

Depending on the satellite geometry and the ship's drift the position error goes down to *1 to 50 NM.*

With COSPAS/SARSAT 406-MHz EPIRBs the amount of false alarms could be reduced dramatically but is still quite high. The major disadvantege of LEO satellites is the dependency of satellites in the low earth orbit. The disabled vessel has to wait for the satellite to pass by. Depending on the lattitude this may take hours. And a *delay of 15 minutes to 4 hours* may apply. COSPAS/SARSAT EPIRBs like the navtec global-C *plus* EPIRB can be fitted with GPS-receivers. This improves the position estimation to an accurate position indication. GPS fitted COSPAS/SARSAT EPIRBs like the navtec global-C *plus* EPIRB can operate via geostationary satellites *(GEOSAR)* when available and when the geometry allows for reaching the satellite.

How will a 406MHz distress beacon help save your life?

- **It works**. Only 406MHz distress beacons are monitored by satellite.
- **It's faster**. Once activated, the signal from a 406MHz distress beacon is picked up almost instantly by satellite. The satellites supporting the old 121.5MHz and 243MHz distress beacons have been deactivated and can can no longer determine your location - this could cost you your life.
- **It's more Accurate**. 406MHz distress beacons give rescuers a search area of approximately 20 square kilometres. However, we strongly recommend GPS equipped EPIRB's as they reduce the search area down to only a few square metres. This takes the 'search' out of search and rescue, and increases your chances of survival. Any 406MHz beacon is a huge improvement on the old 121.5/243MHz beacons.
- **It brings the right response**. With 406MHz distress beacons, alerts are cross-referenced against a database of registered owners. Having this information improves rescuers' ability to help you in an emergency, and to respond appropriately. Being able to contact you (or a person you nominate) also saves time and resources from being wasted on false alerts – out of the 1300 121.5MHz activations in the last two years, only 9% were for a real emergency.

The COSPAS-SARSAT system provides distress alert and location information to search and rescue authorities anywhere in the world for maritime, aviation and terrestrial users in distress.
There are two satellite arrays carrying the COSPAS-SARSAT system. The principal array is LEOSAR (Low Earth Orbit Search and Rescue) which has seven satellites in polar and near-polar orbits. The orbits of these satellites are arranged to scan the entire surface of the Earth; on average, a satellite comes into view every 45 minutes.
Distress transmissions from EPIRBs are picked up by the satellites and retransmitted to ground receiving stations, which then pass the message to the appropriate rescue organisation. On average, the total delay from activation of an EPIRB to the message being received by the rescue services is 90 minutes.
COSPAS-SARSAT is in an advanced stage of commissioning the second satellite array, GEOSAR (Geostationary Search and Rescue). This array uses

geostationary satellites which are always in view (over their area of coverage), so that reception of the EPIRB signal is virtually instantaneous.

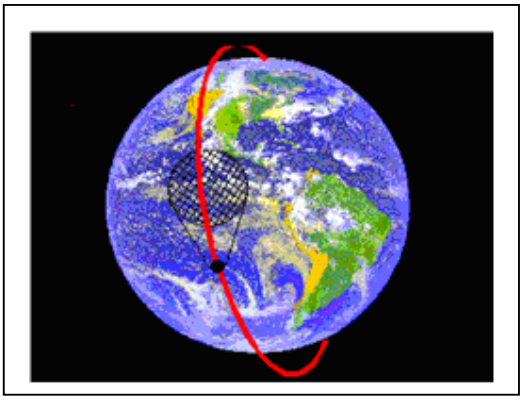


Fig. 14-3 LEOSAR satellite path and scan footprint

Fig. 14-4 GEOSAR coverage

Description of 406 MHz McMurdo EPIRB

The EPIRB is a powerful self-contained distress transmitter. It is powered by a Lithium battery that has a replacement interval of 5 years. An EPIRB is intended to be a one-shot device; once activated it can operate for at least 48 hours. It operates best while floating in water, but it can also be operated while on board or in a liferaft.

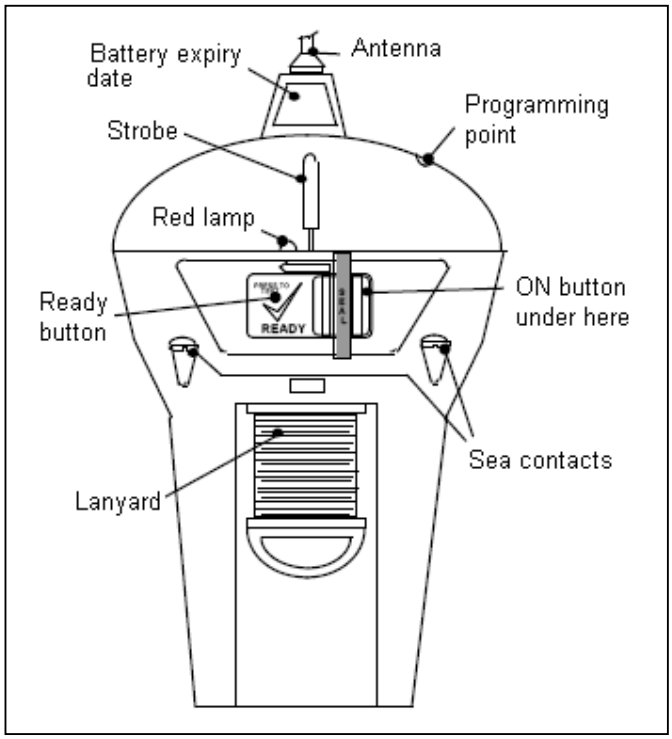


Fig. 14-5 McMurdo EPIRB

The key components of your EPIRB are:

- *Antenna*: This is a flexible whip. It must be near vertical when operating. If the antenna gets bent, gently straighten it out.
- *Strobe light*: This is the glass U -tube visible through the clear lens dome. When the EPIRB is activated this will flash every few seconds.
- *Red lamp* : Visible through the clear lens dome at the rear of the EPIRB. This stays on or flashes to show which mode the EPIRB is in.
- *Program point*: A dimple in the clear dome, through which your supplier can optically input the coded message unique to your EPIRB.
You **must** register the coded message with local authorities.
- *READY button*: Press this key once to de-activate the EPIRB. Hold it down to run the built-in self-test, which checks basic operation.
- *ON button* : Press this key to activate the EPIRB manually. The key is protected by a sliding door which is fitted with a security seal.
- *Sea switch* : The two screw heads below the keys are sea switch contacts. Submerge these in water to automatically activate the EPIRB.
- *Lanyard* : Pull the lanyard spool down to free it. Use the cord to tether the EPIRB to a survival craft.
Never tie the EPIRB to your vessel.

Float-free enclosure

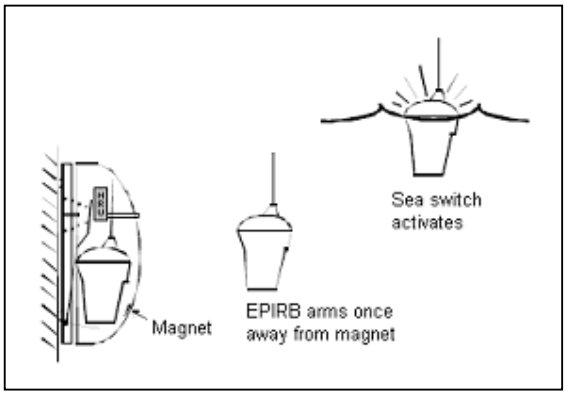


Fig. 14-6 Free float

The diagram above illustrates the automatic release sequence:

1. As the vessel sinks, the enclosure fills with water. The HRU contains a blade which is released due to water pressure acting on a diaphragm.
Before it reaches a depth of 4 metres, the HRU will operate and cut the plastic rod, releasing the coil spring.

2. The spring pushes the EPIRB and the enclosure lid outwards. As the lid pivots off it disengages from the screw head that helped hold it in place. The lid is weighted so it rolls over and falls away.

3. As the EPIRB floats away from the lid, it moves out of range of the magnet. Once away from the magnet its sea switch becomes armed.

4. The sea switch activates. The EPIRB then floats on the surface with its strobe light flashing. After 2 minutes it makes its first distress transmission.
If you need to activate your EPIRB manually, it can be freed from the enclosure after pulling out the R-shaped retaining pin and removing the lid.

Manual activation

If the vessel is not sinking but there is imminent danger, remove the EPIRB from its
bracket and activate it manually as shown below. Note that once activated it will flash immediately, but it will not transmit a distress call for 2 minutes. This gives you a chance to turn it off if you activated it in error.

Once activated the EPIRB **must** have its antenna as upright as possible and it must have a clear view of the sky for proper operation. Laying it on its side or placing it next to a metal wall will impair its range and may fail to alert the rescue services. Avoid handling the antenna, as this will also impair performance.

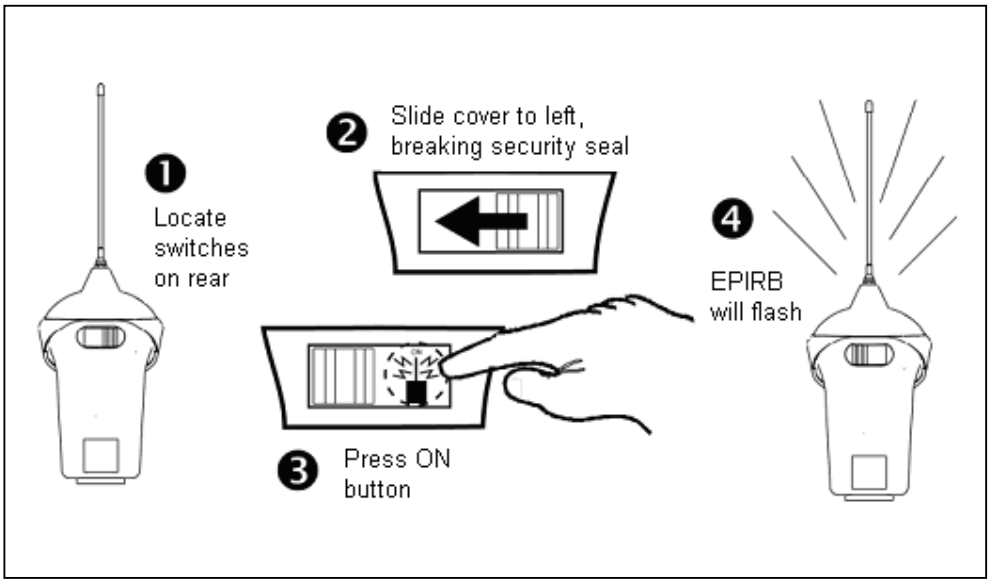


Fig 14-7 Manual activation

Deactivation

If your EPIRB has been activated for a cumulative period in excess of 2 hours then its battery will need replacing. This is necessary to ensure that in an emergency it will operate for the full 48 hours required by government regulations.

If the EPIRB was activated by mistake or if the emergency ends then the EPIRB can be reset back to its "ready" state as follows:

- *Remove EPIRB from any water and dry its sea switch contacts*
- *Wait 8 seconds for sea switch to turn off*

If EPIRB is still flashing then it must have been turned on manually:

- *Slide the switch cover fully to the right.*
- *Press and release READY button.*

If EPIRB is still flashing then it has a fault.

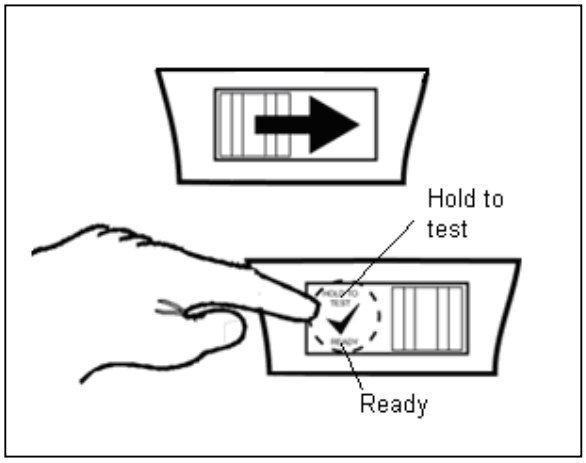


Fig. 14-8 Deactivation of EPIRB

How does it work ?

Your EPIRB contains two radio transmitters: one operating at 406 MHz which transmits an alert which can be received by satellites, and one operating at 121.5 MHz which transmits a signal which can be received by overflying aircraft and Search & Rescue (SAR) homing receivers. When you activate the EPIRB, both transmitters start broadcasting signals. Providing the EPIRB's batteries are in good condition, the transmission will continue for a minimum of 48 hours.

The 406 MHz alert signal can be detected by SAR satellites. American, European and Indian authorities operate a series of satellites in low-earth and geostationary orbits to detect and locate aviators, mariners and land-based users in distress. The satellites, together with a world-wide network of ground stations and Mission Control Centres (MCC) form the International COSPAS-SARSAT Program whose mission is to relay distress signals to the international search and rescue community.

Ground stations track these satellites and process the distress signals to obtain a location (by using Doppler location techniques*) of the distress. The processed information is then forwarded to an MCC where it is combined with other location and registration information and passed to a Rescue Coordination Centre (RCC) which alerts the appropriate SAR authorities. Successive satellite passes refine and confirm this information. Alternatively, some beacons operating at the 406 MHz frequency can use the GPS system to obtain a very accurate position. This position is then transmitted as part of the distress signal.

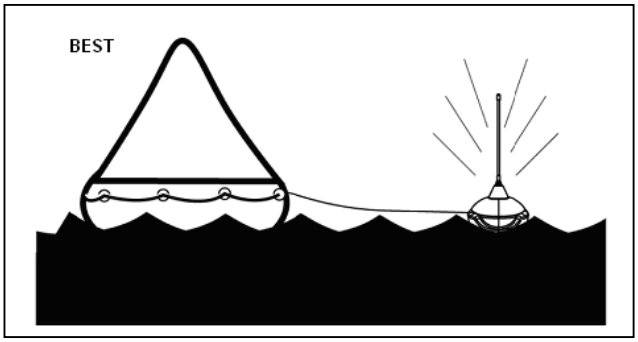
The network of orbiting satellites can detect signals over the entire surface of the earth; in addition, there are four geostationary satellites that appear fixed in position and which detect signals over enormous areas (approximately one-third of the surface of the earth, but excluding Polar regions). However, the geostationary satellites, because they are fixed with respect to the earth, cannot determine the position of the EPIRB using Doppler.

An EPIRB should not be switched off once activated for a distress situation until the SAR agency directs this.

DO:

- Make sure you switch on the EPIRB
- Hold the EPIRB up as high as possible.

Note: the high intensity flashing strobe light may cause discomfort if viewed for prolonged periods.



Carriage requirements for GMDSS in area A1

1. One VHF radio capable of DSC (Digital Selective Calling) on channel 70 and voice communications on channel 16, 13 and 6.
2. One SART (Search And Rescue Transponder) if under 500 gross tons otherwise two.
3. Two approved lifeboat portable VHF radios if under 500 gross tons otherwise two.
4. One Navtex receiver or an Inmarsat EGC receiver if operating in an area where Navtex is not offered.
5. One 406 MHz or a 1.6 GHZ satellite EPIRB, (Emergency Position Indicating Radio Beacon). Note: a VHF DSC EPIRB may replace the 406 MHz and 1.6 MHz EPIRB if operating exclusively in area A1.

14.3 Search and rescue transponder beacons (SARTs)

General requirements, siting and marking of equipment

The radar transponders required by the Regulations should comply with the performance standards adopted by the IMO through Assembly Resolution A.802(19). The equipment should be provided with simple instructions for operation.

The equipment should be kept on either side of the ship in a suitable place ready to be moved into a survival craft in case of emergency; where only one is required, it should be located at a suitable location for moving into the survival craft. In ships where the disposition of superstructures or deck houses is such as to involve substantial fore and aft separation and, where two transponders are carried, they should not be located in the same area of superstructure or in the same deck house.

The equipment should be clearly marked with the manufacturer's identity, type or model identification, serial number, brief operating instructions and the expiry date for the primary batteries used.

The minimum safe distance from the standard or magnetic steering compass at which the equipment may be installed should also be marked;

The arrangements made in individual ships and/or survival craft should be determined to the satisfaction of the marine surveyor in consultation with the radio surveyor who should inspect the equipment as part of each survey of Life-Saving Appliances.

Securing the equipment in lifeboats

Arrangements should be made in every lifeboat carried by the ship for erecting and securing the radar transponder at a height of not less than 1 metre above the water line. It is acceptable to mount the equipment within the lifeboat; e.g.'hang', including enclosed lifeboats of GRP construction, the equipment will operate satisfactorily. Alternatively the radar transponder may form an integral part of the survival craft.

Where lifeboats using 'free-fall launching' techniques are carried each should be provided with appropriate means to securely retain the transponder

during launching. Alternatively the transponder should form an integral part of each lifeboat.

14.3.1 SART principle of operation

Actuating a SART enables a survival craft to show up on a search vessel's radar display as an easily recognised series of dots. RADAR (radio detection and ranging) is a device carried by most ships which is used to determine the presence and location of an object by measuring the time for the echo of a radio wave to return from it, and the direction from which it returns.

A typical ship's radar will transmit a stream of high power pulses on a fixed frequency anywhere between 9.2GHz and 9.5GHz. It will collect the echoes received on the same frequency using a display known as a Plan Position Indicator (PPI), which shows the ship itself at the centre of the screen, with the echoes dotted around it. Echoes further from the centre of the screen are thus further from the ship and the relative or true bearing of each echo can be easily seen.

The SART operates by receiving a pulse from the search radar and sending back a series of pulses in response, which the radar will then display as if they were normal echoes.The first return pulse, if it sent back immediately, will appear in the same place on the PPI as a normal echo would have done. Subsequent pulses, being slightly delayed, appear to the radar like echoes from objects further away.

A series of dots is therefore shown, leading away from the position of the SART. This distinctive pattern is much easier to spot than a single echo such as from a radar reflector. Moreover, the fact that the SART is actually a transmitter means that the return pulses can be as strong as echoes received from much larger objects.

A complication arises from the need for the SART to respond to radars which may be operating at any frequency within the 9GHz band. The method chosen for the SART is to use a wideband receiver (which will pick up any radar pulses in the band), in conjunction with a swept frequency transmitter. Each radar pulse received by the SART results in a transmission consisting of 12 forward and return sweeps through the range 9.2GHz to 9.5GHz.

The radar will only respond to returns close to its own frequency of operation (i.e. within its receive bandwidth), so a "pulse" is produced at the radar input each time the SART sweep passes through the correct frequency. The text and diagrams on Pages 10 & 11 show this in more detail.

A slow sweep would give the radar a stronger echo to deal with as the sweep would be inside the operating bandwidth for a longer period. The delay for the sweep to reach the operating frequency may however lead to an unacceptable range error, as delayed echoes appear to be coming from more distant objects.

To minimise this problem, the SART uses a "sawtooth" response, sweeping quickly, then slowly for each of its twelve forward and return sweeps. At long range, only the slow sweeps, giving the strongest returns, are picked up**.** At close range, where errors are more important, the fast sweeps

are also detected. As the first sweep is a fast one, then the range error is minimised and should be less than 150 metres.

The timescale over which all this occurs is very short. Each "fast" sweep takes about 0.4µs, each "slow" sweep about 7.5µs. The complete series of twelve forward and return sweeps is therefore complete within 100µs. Displayed on the PPI, the spacing between each pair of dots will be 0.6 nautical miles.

On a long range setting, a typical radar will be triggering the SART every millisecond - but only during the period that the rotating radar scanner is pointing in the correct direction. Most modern radars use sophisticated noise rejection techniques, which prevent the display of echoes which are not synchronized with the radar's own transmissions, so one radar will not normally be confused by a SART's response to a neighbouring radar.

The SART indicates that it has been triggered by lighting an indicator LED continuously (it flashes in standby mode) and by sounding an integral buzzer. If no radar pulses are detected for a period exceeding 15 seconds, the SART reverts to "standby" mode.

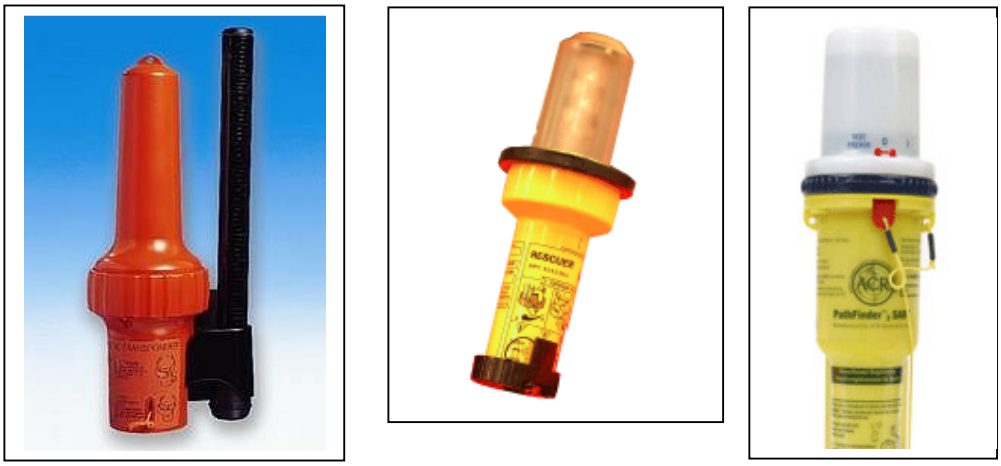


Fig 14-9 Different types of SARTs

LIFERAFT SART

Supplied with or without mast. Normally is packed as part of the liferaft equipment.

The mast version is mounted in the same manner as the carry-off version; the version without the mast is intended to be hung from the highest point inside the liferaft.

14.3.2 Operating instructions

To switch on:

- Break the security tab away from the body of the SART.
- Rotate the switch ring clockwise (ie to the left) to the ON position marked by “1”.

To extend the telescopic pole:

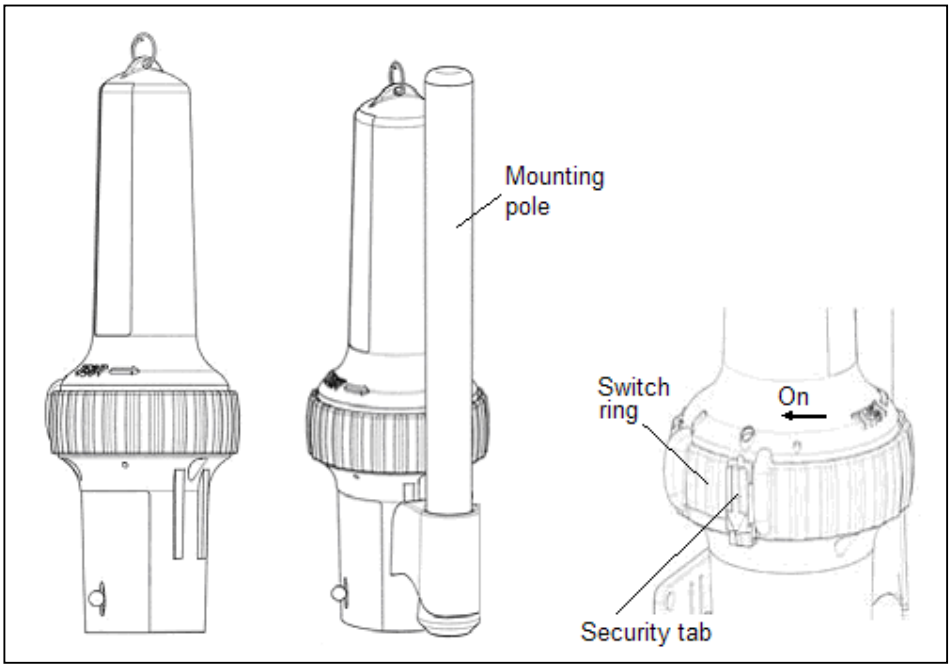
- Grasp rubber cover at bottom of pole, and twist the pole to release it in the pole mount. Pull the pole down and twist to lock in place in the pole mount.
- Remove rubber cover from bottom of pole; allow pole sections to drop. Lock sections together by twisting each section.

To deploy in a survival craft (liferaft):

- Extend the SART supporting pole as detailed above
- Tether the SART to a suitable point using the lanyard which unwinds from its base.
- Inset the SART through the port in the canopy
- Position the bottom of the support pole in the antenna pocket
- Secure the pole to the canopy support.

Some survival craft have the SART already packed as part of the inventory. In general, these models of SART are not fitted with the support pole. The SART should be switched ON then suspended by its top loop from the highest point of the survival craft.

If the lanyard becomes unwound, it may be rewound by rotating the spool in the base of the SART in the direction of the arrow.



14.3.3. Technical description

A single switched antenna is used for both receive and transmit functions; the switch normally connects the antenna to the receiver circuit. In the standby state only the receiver portion of the SART is powered to reduce battery consumption to a minimum. In this condition the indicator circuit causes the LED to flash once every two seconds.

On receipt of a radar pulse the video amplifier and detector circuit causes the rest of the circuitry to become active and the unit switches to transmit mode. In this condition the indicator circuit causes the LED to remain steady and the buzzer to sound every two seconds.

The detection of a radar pulse causes the switch to connect the antenna to the transmitter circuit. The output stage is fed by a Voltage Controlled Oscillator (VCO), whose frequency is determined by a sweep generator. When triggered by the detector the sweep generator turns on the VCO and causes it to produce exactly 12 forward and reverse frequency sweeps before shutting down again.

If no radar pulses are detected for a period of 15 seconds the unit reverts to standby mode.

Start Status	Buzzer	Red led
OFF	OFF	OFF
STAND BY MODE (Test or On)	OFF	FLASHING EVERY 3 Seconds
ACTIVELY TRANSPONDER (Test or On)	ON EVERY 2 Seconds	ON

Fig. 14- 9 Extending of SART

14.4 Distress signals, signalling equipment and pyrotechnics

14.4.1 Distress signals and signalling equipment

Distress signals at sea are defined in the International Regulations for Preventing Collisions at Sea and in the International Code of Signals. Mayday signals must only be used where there is grave and imminent danger to life. Otherwise, urgent signals such as pan-pan can be sent. Most jurisdictions have large penalties for false, unwarranted or prank distress signals.

Distress can be indicated by any of the following officially sanctioned methods:

- transmitting a spoken voice Pan-pan, or a Mayday message by radio over very high frequency (shorter range VHF) channel 16 (156.8 MHz) and/or high frequency (longer range HF) on 2182 kHz
- transmitting a digital distress signal by activating (or pressing) the distress button (or key) on a marine radio equipped with Digital Selective Calling (DSC) over the VHF (channel 70) and/or HF frequency bands.
- transmitting a digital distress signal by activating (or pressing) the distress button (or key) on a Inmarsat-C satellite internet device
- sending the Morse code group SOS by light flashes or sounds
- burning a red flare (either hand-held or aerial parachute flare)
- emitting orange smoke from a canister
- showing flames on the vessel (as from a burning tar barrel, oil barrel, etc)
- raising and lowering slowly and repeatedly both arms outstretched to each side
- making a continuous sound with any fog-signalling apparatus
- firing a gun or other explosive signal at intervals of about a minute
- flying the international maritime signal flags **NC**
- displaying a visual signal consisting of a square flag having above or below it a ball or anything resembling a ball (round or circular in appearance)

The importance of a good lookout cannot be overstated. Remember, when in a life raft, you are so small and the sea is so big that it is very easy for a search ship or plane to overlook you. An alert lookout will make the difference in survival. Once you have sighted a rescue ship or aircraft, use the following to attract their attention:

- *Signalling mirrors*: Read the instructions for the particular kind of signalling mirror in your survival equipment. Do not wait until you see a rescue craft to use the signalling mirror. When the sun is shining, flash the mirror all around the horizon .An aircraft can spot the flash long before you would see the aircraft. The signalling mirror may save your life. Use it as long as the sun is shining.
- *Whistles* In calm weather, your voice can be heard only a few hundred yards away. If you keep screaming, you will become hoarse and lose your voice. A whistle, on the other hand, can be heard up to 4 miles away in favourable weather conditions. It can come in handy when you are floating in the water trying to attract the attention of nearby rescuers. A whistle can be used over and over again. It can be used in fog, at night, or during the day.

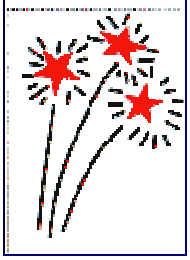
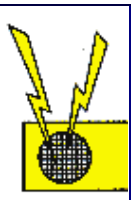
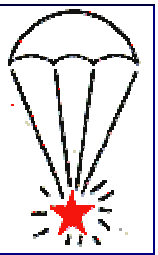
- *Pyrotechnics :* These are signals such as rockets, flares, and smoke. Instructions for operating various brands of pyrotechnics are written by the manufacturers. Once you are settled in your survival craft, read the instructions on each type of pyrotechnic so you will know how to use them when a ship or aircraft is spotted. Keep the pyrotechnics close by for immediate use, so you can signal when necessary. Heed the following when using pyrotechnics:

- Be sure to fire the signals downwind on the lee side of the survival craft. When firing, hold them at a slight angle over the water. Pyrotechnics have burning particles that might fall, which may burn you or damage the raft.

- Only use smoke signals during the daytime. Smoke does not glow in the dark. Only use pyrotechnics when you can see a ship or plane. Do not waste smoke signals.

- Rockets should be used when a vessel is spotted far away on the horizon. A rocket will get the signal higher, where it can be seen from a greater distance.

- An aircraft directly overhead would be more likely to spot a hand flare than a flare covered with a parachute.

			
Red Star Shells	Fog Horn Continuous Soundings	Flames on A Vessel	Gun Fired at Intervals of One Minute
			
Orange Background Black Ball & Square	SOS	"Mayday" by Radio	Parachute Red Flare

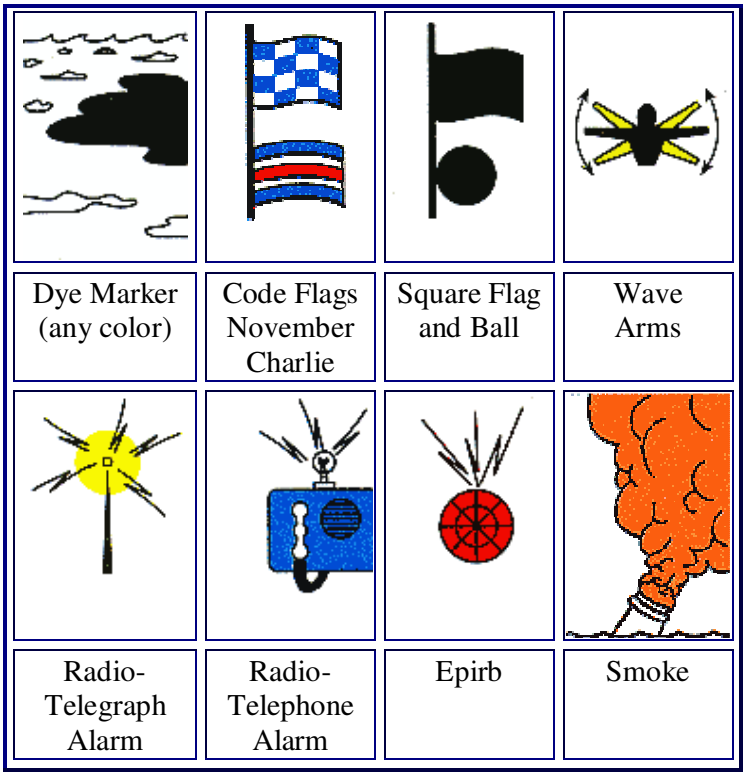


Fig. 14-10 Distress signals

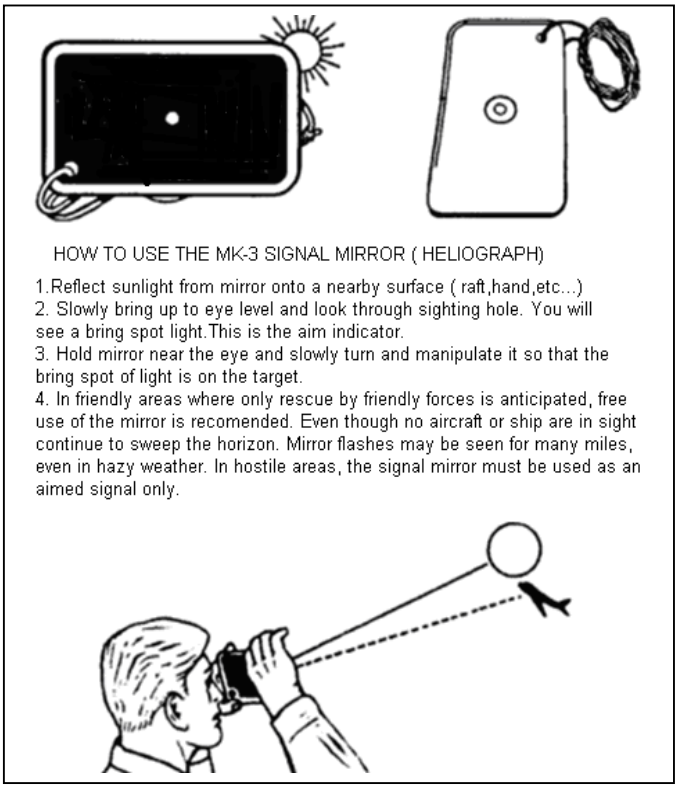

HOW TO USE THE MK-3 SIGNAL MIRROR (HELIOGRAPH)
1.Reflect sunlight from mirror onto a nearby surface (raft,hand,etc...)
2. Slowly bring up to eye level and look through sighting hole. You will see a bring spot light.This is the aim indicator.
3. Hold mirror near the eye and slowly turn and manipulate it so that the bring spot of light is on the target.
4. In friendly areas where only rescue by friendly forces is anticipated, free use of the mirror is recomended. Even though no aircraft or ship are in sight continue to sweep the horizon. Mirror flashes may be seen for many miles, even in hazy weather. In hostile areas, the signal mirror must be used as an aimed signal only.

Fig. 14-11 MK-3 Signal mirror

Fig.14-12 Survival whistle

Fig.14-13 Portable search light

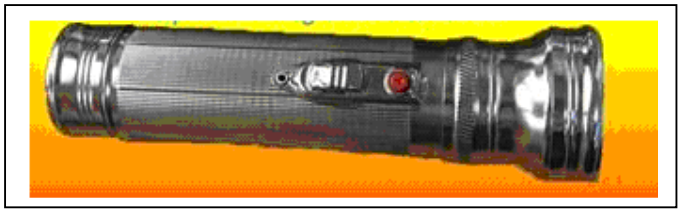


Fig. 14-14 Torch with Morse Code signalling

Electric torch

An electric torch of an accepted type, suitable for Morse signalling, must be provided together with a waterproof container containing one spare set of batteries and one spare bulb. Sample torches submitted for acceptance should be capable of being dropped at any angle on to a hard surface from a height of 1.20 metres without damage affecting the efficient use of the torch,

other than failure of the bulb; it should also withstand immersion under 300 mm of water for a period of six hours without such leakage, discharge of the batteries or other defect, as would affect the efficient use of the torch.

SIGNAL MIRROR INSTRUCTIONS
1. REFLECT SUNLIGHT FROM THE MIRROR ONTO A NEARBY SURFACE I.E. THE GROUND, RAFT, HAND, ETC.
2. SLOWLY BRING THE MIRROR UP TO EYE LEVEL AND LOOK THROUGH THE SIGHTING HOLE. YOU WILL SEE A BRIGHT LIGHT SPOT. THIS IS YOUR AIM INDICATOR.
3. HOLDING THE MIRROR CLOSE TO YOUR EYE, SLOWLY TURN AND MANIPULATE THE AIM INDICATOR (THE BRIGHT SPOT) SO THAT IT IS ON THE TARGET.
4. MOVING THE AIM INDICATOR ON AND OFF THE TARGET WILL CAUSE THE MIRROR TO FLASH IN THE EYES OF YOUR TARGET.
5. CONTINUE SWEEPING THE HORIZON EVEN WHEN THERE ARE NO VISIBLE SEARCH CRAFT. MIRROR FLASHES MAY BE SEEN FOR MANY MILES EVEN IN HAZY WEATHER.
MADE IN JAPAN — COGHLAN'S LTD. WINNIPEG, CANADA R3T 4C7

Fig. 14-15 Signal mirror

A signal mirror is one of the cheapest and most effective emergency signalling devices a person can carry and with training can even be used in overcast conditions and at night.

14.4.2 Pyrotechics

Red parachute flares

Are used to attract the attention of searching ships and aircraft some distance off.
Only red parachute flares indicate distress.

The signals can be sighted at a long range and identify the general area of search. If the searching boat or aircraft alter course, a second parachute rocket or hand flare should be fired.

Their range is :

- 25 nautical miles by night
- 8 nautical miles or less by day

The signals burn for about 40 seconds failing from a height of about 300 meters.
The procedures for firing a parachute rocket are printed in English and in picture format on every rocket.

Fig. 14-16 Different types of Red Parachute Flares

You must read and follow these procedures. Rockets can be fired by hand with negligible recoil.

In strong winds, aim the rocket slightly downwind. This will prevent the spent flare possible landing on the raft .

Ensure that the rocket is pointing upwards and clear of the survival craft. It can cause injury if fired towards someone.

In order to be seen in low cloud conditions, it is best to fire the rocket at an angle of 45°.

Never fire the rocket directly at an aircraft.

The intense brilliance of the red parachute rocket achieves 40,000 candela.

The use or exhibition of any of the foregoing signals [as a hand flare showing a red light or rockets or shells, throwing red stars] except for the purpose of indicating distress and need of assistance and the use of other signals which may be confused with any of the above signals is prohibited." from the COLREGS ANNEX IV.

Hand Held Red Flares

Hand flares are used to guide the searching ship or aircraft or pinpoint the survivors position. They are ideal for day or night use.

Their range is :

- 5 nautical miles by day
- 10 nautical miles by night

They burn for about 60 seconds and brilliance about 15.000 candela.

Read the operating instructions on each hand flare as they may be different.

The burning flare should be held downwind to prevent sparks falling onto the survival craft.

Hold the flare by gripping it at the safe holding position marked on the flare and tilt the flare.

Wrap your hand in wet cloth or towel to protect it against radiating heat and falling sparks.

Fig. 14 -17 Red hand flares

Smoke signals

Smoke signals are of two types:

- buoyant orange smoke signals
- hand-held orange smoke signals.

Smoke signals are used to pinpoint the survivors' position.

The smoke signal's use to raise an alarm is doubtful. They will be more readily seen from an aircraft than a surface craft. They are for daytime use only.

Their range is at the most about two to three nautical miles in good visibility.

The buoyant float smokes for at least 3 minutes.

Visible distance≥2miles

Hand held smoke signal give smoke for about 1 minute. They should be used on the lee side of the survival craft.

Remember, they are good for signalling when winds are light. In strong winds, however, the smoke may disperse quickly.

Fig.14-18 Hand held orange smoke signal

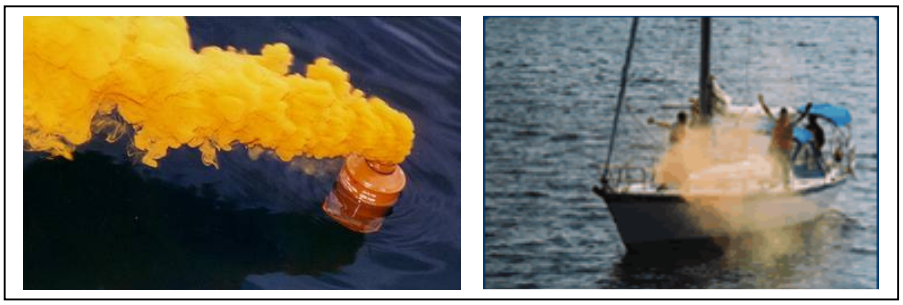


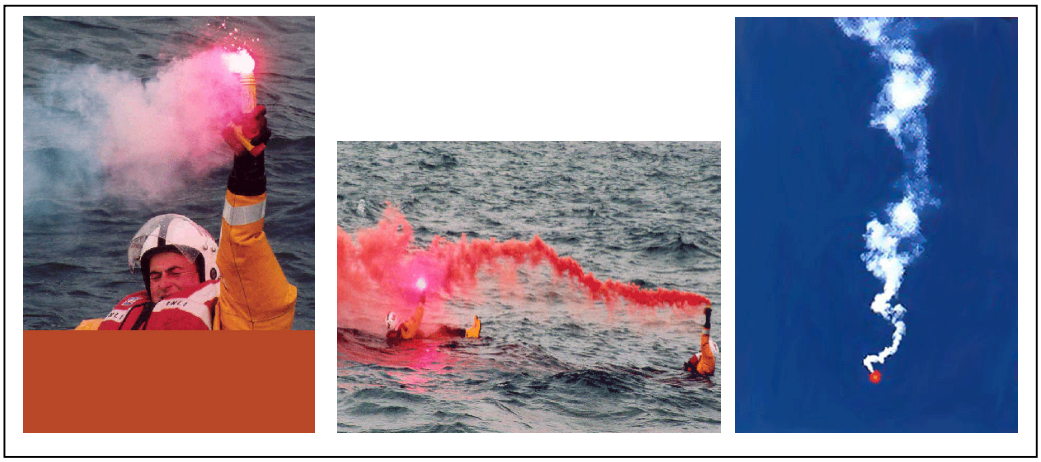
Fig.14-19 Hand held orange smoke signal

When and how to use each of the pyrotechnics

Lifesmoke :- A small and compact distress signal for daylight use only. Signal for position marking during rescue operations Indicates wind direction Safe use on oil or petrol covered water.

Red Handflare:- For use day or night the red handflare is a short-range distress signal used to pinpoint position. May be carried on the ship's bridge and is a requirement in ship's lifeboats and liferafts.

Parachute Red Rocket:- A day or night long-range distress signal.



15. First aid

15.1 Resuscitation techniques

15.1.1 Mouth-to-Mouth (mouth-to-nose) resuscitation

1. Make sure the person is lying on a hard, flat surface. Look into the mouth and throat to ensure that the airway is clear. If an object is present, try to sweep it out with your fingers (wear disposable surgical gloves if they are available). Apply the Heimlich manoeuver if unsuccessful and the object is blocking the airway. If vomiting occurs, turn the person on his or her side and sweep out the mouth with two fingers. Do not place your finger in the mouth if the person is rigid or is having a seizure.

2. Tilt the head back slightly to open the airway. Put upward pressure on the jaw to pull it forward.

3. Pinch the nostrils closed with thumb and index finger. Place your mouth tightly over the person's mouth. Use a mouthpiece if one is available. Blow two quick breaths and watch for the person's chest to rise.

4. Release the nostrils. Look for the person's chest to fall as he or she exhales. Listen for the sounds of breathing. Feel for the person's breath on your cheek. If the person does not start breathing on his or her own, repeat the procedure.

Open the airway

The airway is the tube through which air passes from the mouth and nose to the lungs. If it is blocked the patient cannot breathe and air cannot get into or out of the lungs. A patient who cannot breathe will die within four minutes.

In an unconscious patient the tongue may block the throat and the airway. Make sure the airway is open and air can get down the throat. (Fig.15-1).

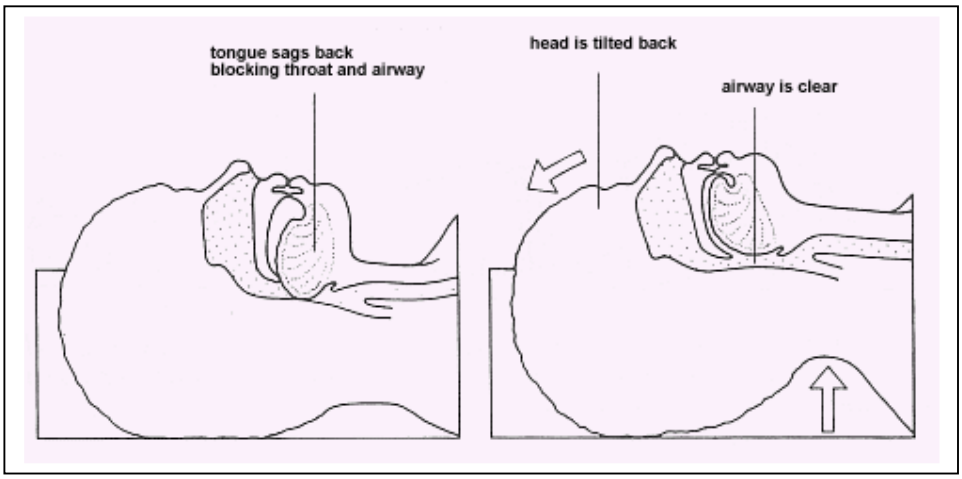


Fig. 15-1 *In an unconscious patient, the tongue may fall back, blocking the throat and stopping breathing.*

Place the patient on his or her back.

Tilt the head back and lift the chin up with the finger and thumb of one hand on the bony part of the chin, while pressing the forehead back with the other hand. This will open the airway and stop the tongue blocking the throat. (Fig.15-2).

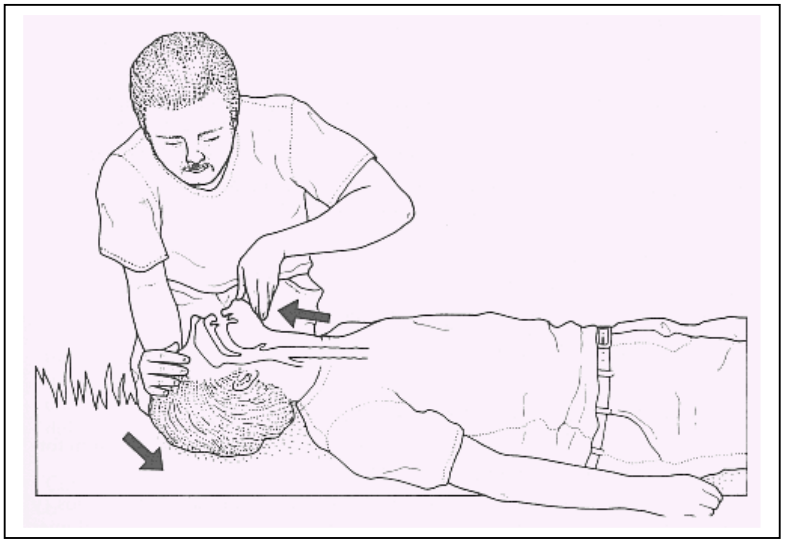


Fig. 15-2 Open up the airway by pressing the forehead back and lifting the clin with the thumb and fingers.

Check whether the patient is breathing

After opening the airway, quickly check whether the patient is breathing (Fig. 15-3):

- Look for the belly or the chest moving up and down.
- Feel the chest moving up and down.
- Feel the patient's breath on your cheek.
- Listen for breath sounds. Put your ear close to the patient's mouth.

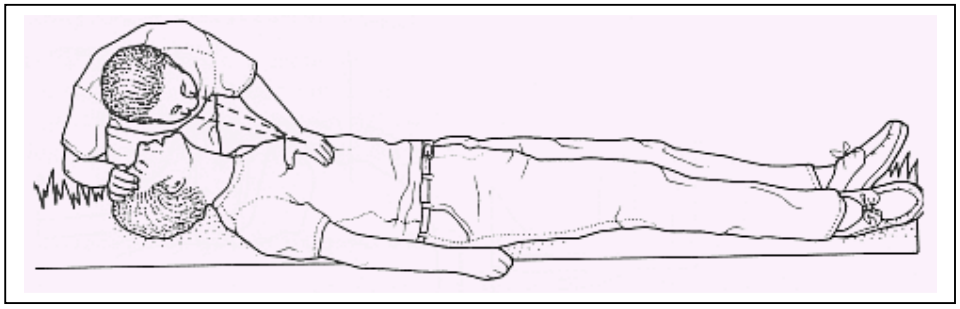


Fig.15-3 Check whether the pacient is breathing by looking and feeling for movement of the chest or belly, listening for breathing sounds and feeling for the pacient's breath on your check.

Use all four checks. Remember that the chest may move up and down even when the throat is completely blocked and air cannot get to the lungs.

Clean out the mouth and clear the throat

If the patient is not breathing after you have tilted the head back, something may be blocking the throat.

Turn the head to one side. With one or two fingers (and preferably wearing gloves) scoop deeply round the mouth and throat to clear any blockage such as vomit (Fig.15-4). Take out the patient's false teeth.

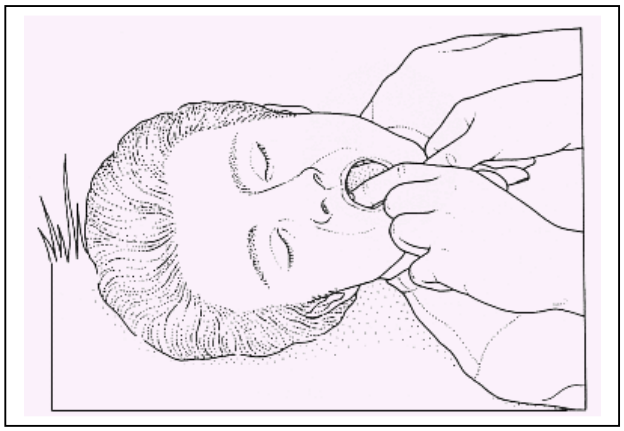


Fig. 15-4 Clear any blockage

If the patient starts breathing turn him or her onto one side, into the recovery position. Check breathing and pulse frequently.

Whatever the cause, if the patient does not start breathing you must act immediately to help the patient to breathe.

How to give mouth-to-mouth respiration or mouth-to-nose respiration to an adult

1. With the patient lying flat on his or her back, clear any blockage from the mouth. Kneel beside the patient's head.
2. Tilt the head back.
3. Pinch the nose with one hand. With the other hand pull the mouth open.Do not press on the neck. For mouth-to-nose respiration, close the patient's mouth with your thumb.(Fig.15-5).

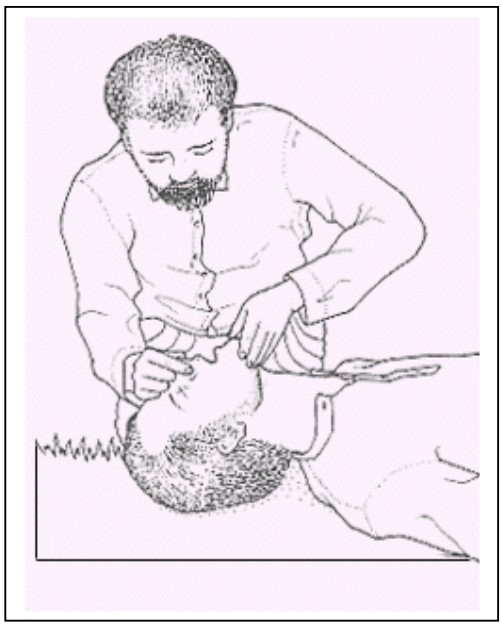


Fig.15-5 Mouth-to-nose respiration: tilt the head back, pinch the nose and pull the mouth open.

4. Breathe in deeply. Cover the patient's mouth completely with your own mouth and breathe out steadily and smoothly so that all your breath goes into the patient's mouth. Breathe out strongly to fill the chest (Fig.15-6). Look for the patient's chest rising. For mouth-to-nose respiration put your mouth around the patient's nose.

5. Lift your mouth away so that the patient can breathe out and you can take another breath of air. Turn your head, look for the chest falling, feel the breathed-out air on your cheek, and listen for the sound of the patient breathing out (Fig.15-7). For mouth-to-nose respiration you may have to open the patient's mouth to let air out.

Fig.15-6
Mouth-to-nose respiration: breather steadily and smoothly into the patient's mouth, filling his or her chest with air.

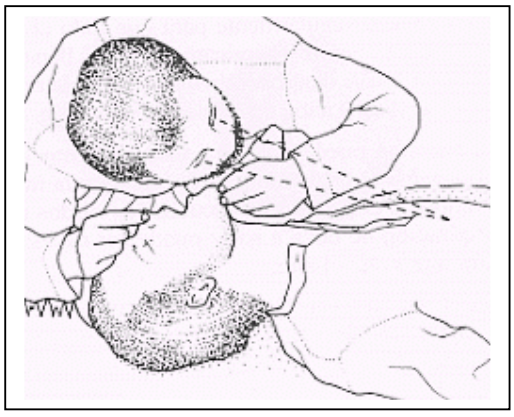


Fig.15-7
Mouth-to-nose respiration: lift your mouth away so that the patient can breathe out; watch for the chest falling, feel for the patient's breath on your cheek, and listen for the sound of breathing.

6. Take another breath of air. Once the chest has fallen, blow into the patient's mouth (or nose) again. Watch the patient breathe out again. Then check that the heart is beating.

If the chest does not rise with each breath, and you cannot feel or hear the patient breathing out, then either the airway is blocked or some of your breath is not going into the patient's chest. Check that the head is held well back and clear the airway again. Make sure there is no air escaping when you breathe into the patient's mouth (or nose).

15.1.2 Cardiac arrest

Cardiac arrest signs and symptoms

Cardiac arrest is classified into "shockable" versus "non–shockable", based upon the ECG rhythm. The two shockable rhythms are ventricular fibrillation and pulseless ventricular tachycardia while the two non–shockable

rhythms are asystole and pulseless electrical activity. This refers to whether a particular class of disrhythmia is treatable using defibrillation.

Cardiac arrest is an abrupt cessation of pump function in the heart (as evidenced by the absence of a palpable pulse). Cardiac arrest can usually be reversed with prompt intervention, but without such intervention, it will almost always lead to death. In certain cases, it is an expected outcome to a serious illness.

However, due to inadequate cerebral perfusion, the patient will be unconscious and will have stopped breathing. The main diagnostic criterion to diagnose a cardiac arrest, (as opposed to respiratory arrest which shares many of the same features), is lack of circulation, however there are a number of ways of determining this.

How to give heart massage to an adult

1. Check that there is no heartbeat.
2. Lay the patient on his or her back on a firm surface. Kneel beside the patient's chest.
3. Find the right place to put your hands. Find the lower edge of the ribs.

Follow the edge of the ribs to where they meet the breastbone. Place your middle finger on the base of the breastbone, and the index finger next to it (Fig. 15-8), then place the heel of your other hand next to these two fingers, on the breastbone in the midline of the chest (Fig. 15-9).

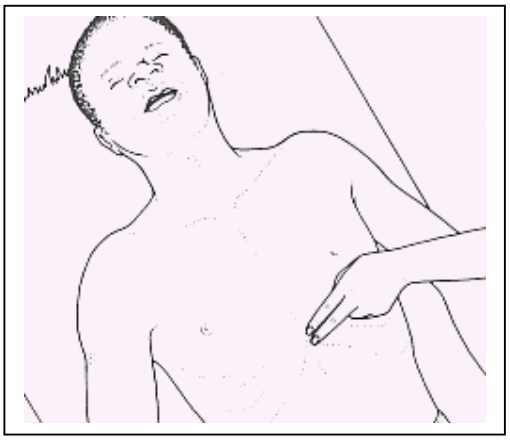


Fig.15-8 Place your middle finger on the base of the breastbone and your index finger next to it

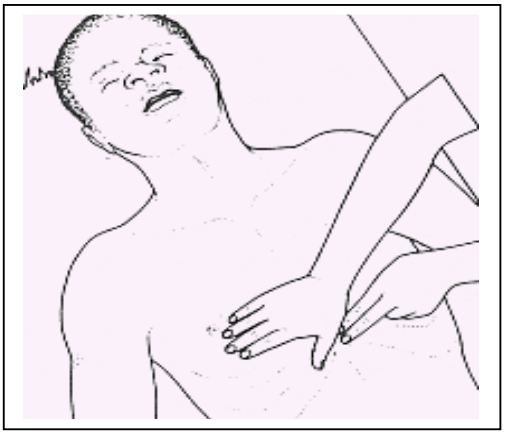


Fig.15-9 Place the heel of your free hand next to the two fingers on the breastbone.

4. Now cover this hand with the heel of your other hand, lock your fingers together, keeping them off the chest . Put your shoulders above the patient's chest and keep your arms straight.

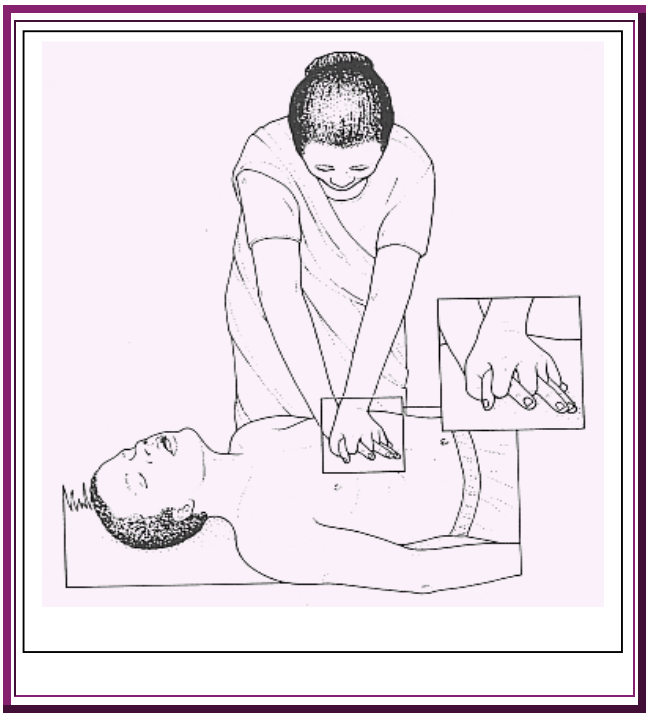


Fig.15-10 Interlock the fingers of both hands and, with the arms straight, press down 4-5 cm.

5. Press down on the lower half of the breastbone 4-5 centimetres, keeping your arms straight. Then stop pushing. While counting "one and two and three and...", press 15 times, in time with the numbers (80 presses a minute). Presses should be regular and smooth, not jerky and jabbing.

6. Remember that both mouth-to-mouth respiration and heart massage are needed. After 15 presses tilt the head back again so that air can get down the throat, put your mouth round the patient's mouth and give two breaths.

7. Continue with 15 presses followed by two full breaths. After one minute check the heartbeat, then after 3 minutes or every 12 cycles check the heartbeat again. As soon as the heartbeat returns stop heart massage immediately. You may see the patient's colour become more normal and the pupils return to normal size.

8. Continue mouth-to-mouth respiration at 12 breaths a minute, until the patient breathes without help. It may be some time before breathing starts again, even after the heart has started beating. When breathing starts again put the patient onto his or her side in the recovery position.

If another person is with you, get him or her to do the breathing while you do the heart massage (Fig. 15-11). The other person should kneel by the patient's head while you kneel by the middle of the chest. The other person should give two breaths and check the heartbeat. If there is no heartbeat you should give five presses on the chest. Continue with the other person giving

one breath and you giving five presses on the chest. Check the heartbeat after one minute then after every three minutes or 12 cycles.

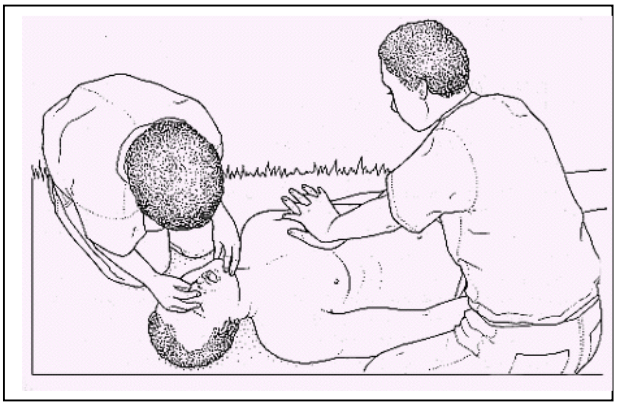


Fig. 15-11 If there are two of you, work together so that one person gives heart massage while the other gives mouth-to-mouth respiration

15.1.3 Recovery position for an unconscious person

An unconscious patient should be turned to lie on one side to stop the tongue blocking the throat and to allow fluid to come out of the mouth. This is called the recovery position.

Before you turn the patient over:

- If breathing is noisy, sweep your finger round the mouth to remove

anything blocking the airway, and take out the patient's false teeth if they are loose.

- Empty the patient's pockets of anything that would be uncomfortable to lie on.
- Take off the patient's spectacles in case they injure the eyes.
- Look for injury to the head or neck, and feel with your fingers to see whether the back of the neck or the backbone is bent or swollen.
- Get help if the patient has an injury to the head or neck. Three people should roll the patient keeping the head, neck and body in a straight line. Do not let the patient sit up when he or she wakes up.

The patient should be turned onto one side with:

- the head, neck and body in a straight line,
- the head placed so that the tongue will not block the throat, and vomit or saliva can come out of the mouth;
- the arms and legs placed so that the patient stays in the same position.

One way of turning a patient

1. Kneel beside the patient, turn the patient's face towards you, and tilt it back, with the jaw jutting forward so the airway stays open. Place the arm nearest you above the head. Place the patient's other arm across the chest. Raise the patient's far leg under the knee, to bend it (Fig.15-12).

Fig.15-12 Putting a patient into the recovery position: place the arm nearest you above the patient's head, bring the other arm across the chest, and bend the leg further from you.

2. Protect the patient's face with one hand. With your other hand, grasp the patient's clothes at the hip and pull the patient towards you until he or she is resting on one side, against your knees (Fig. 15-13).The patient's head should be resting on the lower arm. Check that the airway is still open.

3. Take the patient's upper arm and place the hand under the face (Fig. 15-14). This will help to keep the head tilted back and the airway open. Now position the upper leg so that the bent knee rests on the ground and supports the patient's body.

If the patient is too heavy for you, get help. Someone else can support the patient's head while you do the turning, or can push the patient towards you as you pull.

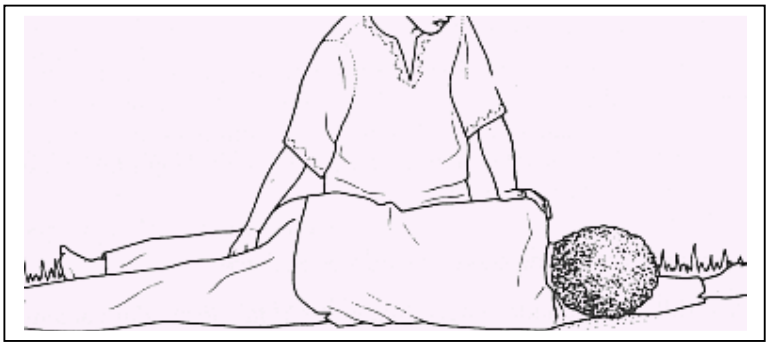


Fig.15-13:Pull the patient towards you until he is lying on one side with the head resting on the arm.

Fig.15-14 Make sure that the patient's head is tilted back so that the airway stays open

15.2 Use of first-aid kit

15.2.1 First aid kit content

An adequate number of first aid kits must be provided by an employer in his establishment. The kits must be placed as near as possible from the work premises, be easy to reach and available at all times.

The minimum content of the first aid kit is the following:

a. A first-aid manual approved by the Commission
b. The following instruments:
   - 1 pair bandage scissors
   - 1 pair splinter forceps
   - 12 safety pins (assorted sizes)
c. The following dressings (or equivalent sizes):
   - 25 sterile bandages (25 mm x 75 mm), individually wrapped
   - 25 sterile gauze squares (101 mm x 101 mm), individually wrapped
   - 4 rolls sterile gauze bandage (50 mm x 9 m), individually wrapped
   - 4 rolls sterile gauze bandage (101 mm x 9 m), individually wrapped
   - 6 triangular bandages
   - 4 sterile bandage compresses (101 mm x 101 mm), individually wrapped
   - 1 roll adhesive tape (25 mm x 9 m)
d. Antiseptics
   - 25 alcohol swabs, individually wrapped.

In addition, a few other suggested items are as follows :

- Gloves
- Disposable emergency blanket
- Instant Cold pack
- Instant Hot pack
- CPR pocket mask with O_2 inlet
- Blood exposure report sheet
- Adrenalin injection report sheet

15.2.2 How to deal with fractures

Forearm Fracture

There are two long bones in the forearm, the radius and the ulna. When both are broken, the arm usually appears to be deformed. When only one is broken, the other acts as a splint and the arm retains a more or less natural appearance. Any fracture of the forearm is likely to result in pain, tenderness, inability to use the forearm, and a kind of wobbly motion at the point of injury. If the fracture is open, a bone will show through a bone will show through.

If the fracture is open, stop the bleeding and treat the wound. Apply a sterile dressing over the wound. Carefully straighten the forearm. (Remember that rough handling of a closed fracture may turn it into an open fracture.)

Apply a pneumatic splint if available; if not, apply two well-padded splints to the forearm, one on the top and one on the bottom. Be sure that the splints are long enough to extend from the elbow to the wrist. Use bandages to hold the splints in place. Put the forearm across the chest. The palm of the hand should be turned in, with the thumb pointing upward. Support the forearm in this position by means of a wide sling and a cravat bandage, as shown in figure 15-15. The hand should be raised about 4 inches above the level of the elbow. Treat the victim for shock and evacuate as soon as possible.

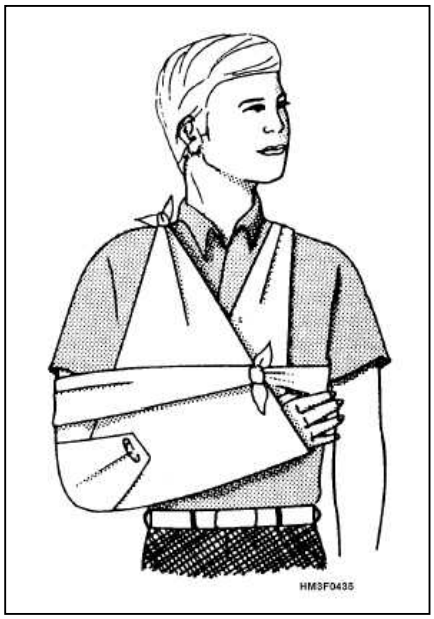


Fig. 15 -15 First aid for a fractured forearm

Upper Arm Fracture

The signs of fracture of the upper arm include pain, tenderness, swelling, and a wobbly motion at the point of fracture. If the fracture is near the elbow, the arm is likely to be straight with no bend at the elbow. If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture.

NOTE: Treatment of the fracture depends partly upon the location of the break. If the fracture is in the upper part of the arm near the shoulder, place a pad or folded towel in the armpit, bandage the arm securely to the body, and support the forearm in a narrow sling. If the fracture is in the middle of the upper arm, you can use one well-padded splint on the outside of the arm.

The splint should extend from the shoulder to the elbow. Fasten the splinted arm firmly to the body and support the forearm in a narrow sling, as shown in figure. Another way of treating a fracture in the middle of the upper arm is to fasten two wide splints (or four narrow ones) about the arm and then support the forearm in a narrow sling. If you use a splint between the arm and the body, be very careful that it does not extend too far

up into the armpit; a splint in this position can cause a dangerous compression of the blood vessels and nerves and may be extremely painful to the victim. If the fracture is at or near the elbow, the arm may be either bent or straight. No matter in what position you find the arm, **DO NOT ATTEMPT TO STRAIGHTEN IT OR MOVE IT IN ANY WAY**. Splint the arm as carefully as possible in the position in which you find it. This will prevent further nerve and blood vessel damage. The only exception to this is if there is no pulse distal to the fracture, in which case gentle traction is applied and then the arm is splinted. Treat the victim for shock and get him under the care of a medical officer as soon as possible.

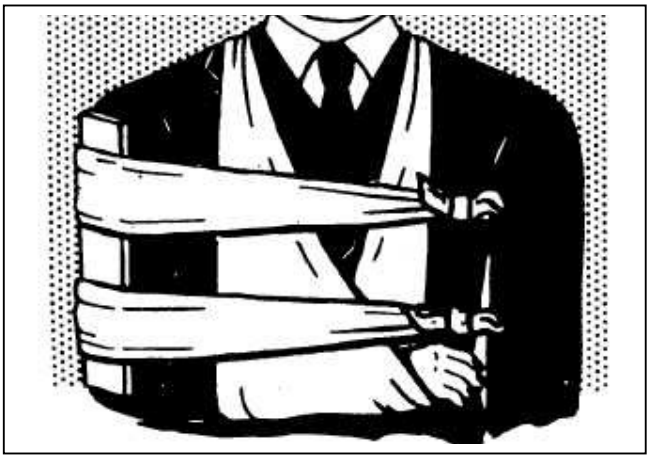


Fig.15-16 Splint and sling for a fractured upper arm

Thigh Fracture

The femur is the long bone of the upper part of the leg between the kneecap and the pelvis. When the femur is fractured through, any attempt to move the limb results in a spasm of the muscles and causes excruciating pain. The leg has a wobbly motion, and there is complete loss of control below the fracture. The limb usually assumes an unnatural position, with the toes pointing outward.

By actual measurement, the fractured leg is shorter than the uninjured one because of contraction of the powerful thigh muscles. Serious damage to blood vessels and nerves often results from a fracture of the femur, and shock is likely to be severe. If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture itself. Serious bleeding is a special danger in this type of injury, since the broken bone may tear or cut the large artery in the thigh.

Carefully straighten the leg. Apply two splints, one on the outside of the injured leg and one on the inside. The outside splint should reach from the armpit to the foot. The inside splint should reach from the crotch to the foot. The splints should be fastened in five places: (1) around the ankle; (2) over the knee; (3) just below the hip; (4) around the pelvis; and (5) just below the armpit (fig. 15-17).The legs can then be tied together to support the injured leg as firmly as possible.

It is essential that a fractured thigh be splinted before the victim is moved. Manufactured splints, such as the Hare or the Thomas half-ring traction

splints, are best, but improvised splints may be used. Figure 15-17 shows how boards may be used as an emergency splint for a fractured thigh. Remember,

DO NOT MOVE THE VICTIM UNTIL THE INJURED LEG HAS BEEN IMMOBILIZED. Treat the victim for shock, and evacuate at the earliest possible opportunity.

Lower Leg Fracture

When both bones of the lower leg are broken, the usual signs of fracture are likely to be present. When only one bone is broken, the other one acts as a splint and, to some extent, prevents deformity of the leg. However, tenderness, swelling, and pain at the point of fracture are almost always present. A fracture just above the ankle is often mistaken for a sprain. If both bones of the lower leg are broken, an open fracture is very likely to result. If the fracture is open, stop the bleeding and treat the wound. Carefully straighten the injured leg.

Apply a pneumatic splint if available; if not, apply **three** splints, one on each side of the leg and one underneath. Be sure that the splints are well padded, particularly under the knee and at the bones on each side of the ankle. A pillow and two side splints work very well for treatment of a fractured lower leg.

Place the pillow beside the injured leg, then carefully lift the leg and place it in the middle of the pillow. Bring the edges of the pillow around to the front of the leg and pin them together. Then place one splint on each side of the leg (over the pillow), and fasten them in place with strips of bandage or adhesive tape. Treat the victim for shock and evacuate as soon as possible.

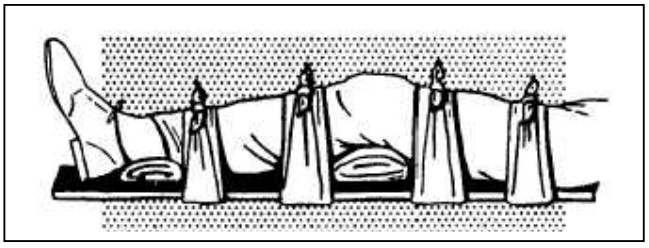


Fig.15-17 Splint for a fractured femur

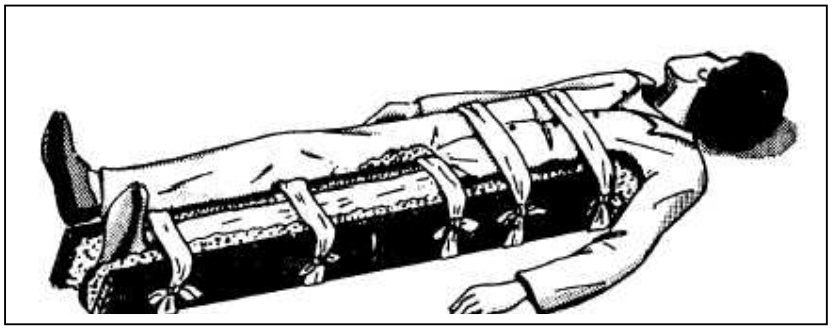


Fig.15-18 Immobilization of a fractured patella

Kneecap Fracture

The following first aid treatment should be given for a fractured kneecap (patella): Carefully straighten the injured limb. Immobilize the fracture by placing a padded board under the injured limb.
The board should be at least 4 inches wide and should reach from the buttock to the heel. Place extra padding under the knee and just above the heel, as shown in figure 15-18.
Use strips of bandage to fasten the leg to the board in four places: (1) just below the knee; (2) just above the knee; (3) at the ankle; and (4) at the thigh. Do not cover the knee itself. Swelling is likely to occur very rapidly, and any bandage or tie fastened over the knee would quickly become too tight. Treat the victim for shock and evacuate as soon as possible.

Clavicle Fracture

A person with a fractured clavicle usually shows definite symptoms. When the victim stands, the injured shoulder is lower than the uninjured one. The victim is usually unable to raise the arm above the level of the shoulder and may attempt to support the injured shoulder by holding the elbow of that side in the other hand.
This is the characteristic position of a person with a broken clavicle. Since the clavicle lies immediately under the skin, you may be able to detect the point of fracture by the deformity and localized pain and tenderness. If the fracture is open, stop the flow of blood and treat the wound before attempting to treat the fracture. Then apply a sling and swathe splint as described below (and illustrated in figure 15-19).
Bend the victim's arm on the injured side, and place the forearm across the chest. The palm of the hand should be turned in, with the thumb pointed up. The hand should be raised about 4 inches above the level of the elbow. Support the forearm in this position by means of a wide sling. A wide roller bandage (or any wide strip of cloth) may be used to secure the victim's arm to the body. A figure-eight bandage may also be used for a fractured clavicle. Treat the victim for shock and evacuate to a definitive care facility as soon as possible.

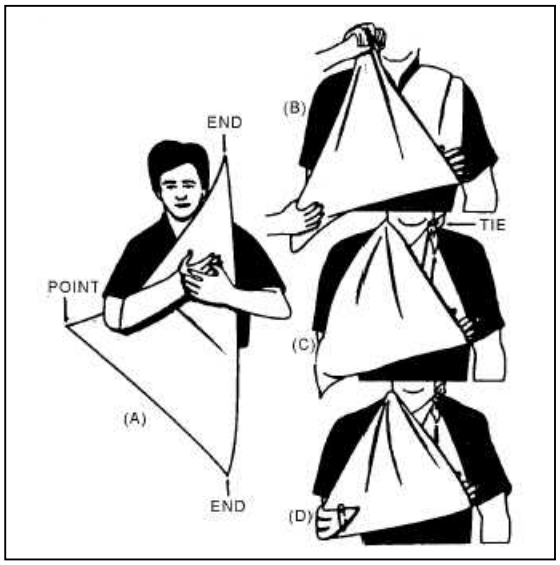


Fig.15-19 Sling for immobilizing fractured clavicle

Rib Fracture

If a rib is broken, make the victim comfortable and quiet so that the greatest danger the possibility of further damage to the lungs, heart, or chest wall by the broken ends is minimized. The common finding in all victims with fractured ribs is pain localized at the site of the fracture.

By asking the patient to point out the exact area of the pain, you can often determine the location of the injury. There may or may not be a rib deformity, chest wall contusion, or laceration of the area. Deep breathing, coughing, or movement is usually painful. The patient generally wishes to remain still and may often lean toward the injured side, with a hand over the fractured area to immobilize the chest and to ease the pain.

Ordinarily, rib fractures are **not** bound, strapped, or taped if the victim is reasonably comfortable. However, they may be splinted by the use of external support. If the patient is considerably more comfortable with the chest immobilized, the best method is to use a swathe (fig.15-20) in which the arm on the injured side is strapped to the chest to limit motion.

Place the arm on the injured side against the chest, with the palm flat, thumb up, and the forearm raised to a 45°angle. Immobilize the chest, using wide strips of bandage to secure the arm to the chest. Do not use wide strips of adhesive plaster applied directly to the skin of the chest for immobilization since the adhesive tends to limit the ability of the chest to expand (interfering with proper breathing).

Treat the victim for shock and evacuate as soon as possible.

Fig. 15-20 Swathe bandage of fractured rib victim

Nose Fracture

A fracture of the nose usually causes localized pain and swelling, a noticeable deformity of the nose, and extensive nosebleed. Stop the nosebleed. Have the victim sit quietly, with the head tipped slightly backward. Tell the victim to breathe through the mouth and not to blow the nose. If the bleeding does not stop within a few minutes, apply a cold compress or an ice bag over the nose.
Treat the victim for shock. Ensure the victim receives a medical officer's attention as soon as possible. Permanent deformity of the nose may result if the fracture is not treated promptly.

Jaw Fracture

A person who has a fractured jaw may suffer serious interference with breathing. There is likely to be great difficulty in talking, chewing, or swallowing. Any movement of the jaw causes pain. The teeth may be out of line, and there may be bleeding from the gums. Considerable swelling may develop.

One of the most important phases of emergency care is to clear the upper respiratory passage of any obstruction. If the fractured jaw interferes with breathing, pull the lower jaw and the tongue well **forward** and keep them in that position. Apply a four-tailed bandage, as shown in figure 15-21.

Be sure that the bandage pulls the lower jaw **forward**. Never apply a bandage that forces the jaw backward, since this might seriously interfere with breathing. The bandage must be firm so that it will support and immobilize the injured jaw, but it must not press against the victim's throat. Be sure that the victim has scissors or a knife to cut the bandage in case of vomiting. Treat the victim for shock and evacuate as soon as possible.

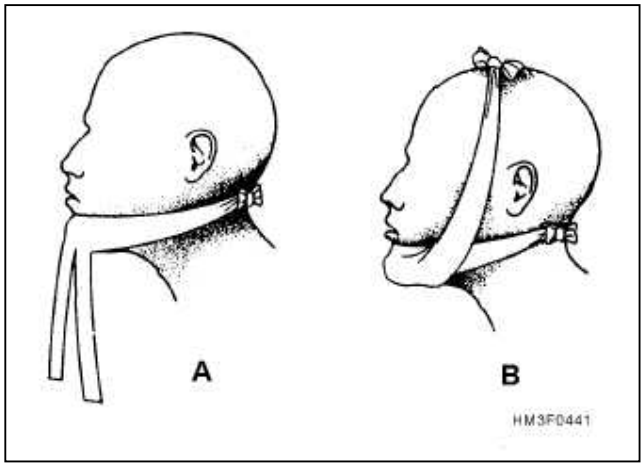


Fig.15-21 Four-tailed bandage for the jaw

Pelvic Fracture

Fractures in the pelvic region often result from falls, heavy blows, and accidents that involve crushing. The great danger in a pelvic fracture is that

the organs enclosed and protected by the pelvis may be seriously damaged when the bony structure is fractured. In particular, there is danger that the bladder will be ruptured.

There is also danger of severe internal bleeding; the large blood vessels in the pelvic region may be torn or cut by fragments of the broken bone. The primary symptoms of a fractured pelvis are severe pain, shock, and loss of ability to use the lower part of the body.

The victim is unable to sit or stand. If the victim is conscious, there may be a sensation of "coming apart." If the bladder is injured, the victim's urine may be bloody. *Do not move the victim unless ABSOLUTELY necessary.*
The victim should be treated for shock and kept warm but should not be moved into the position ordinarily used for the treatment of shock. If you must transport the victim to another place, do it with the utmost care. Use a rigid stretcher, a padded door, or a wide board.

Keep the victim supine. In some cases, the victim will be more comfortable if the legs are straight, while in other cases the victim will be more comfortable with the knees bent and the legs drawn up. When you have placed the victim in the most comfortable position, immobilization should be accomplished. Fractures of the hip are best treated with traction splints.

Adequate immobilization can also be obtained by placing pillows or folded blankets between the legs as shown in figure 15-22 and using cravats, roller bandages, or straps to hold the legs together, or through the use of MAST garments. Fasten the victim securely to the stretcher or improvised support, and evacuate very carefully.

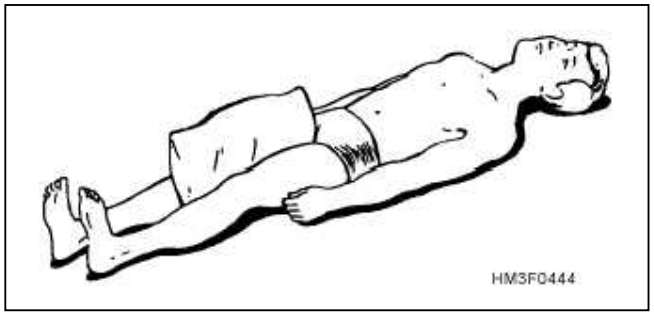


Fig.15-22 Immobilizing a fractured pelvis

15.2.3 Control of Haemorrhaging

The best way to control external bleeding is by applying a compress to the wound and exerting pressure directly to the wound. If direct pressure does not stop the bleeding, pressure can also be applied at an appropriate pressure point. At times, elevation of an extremity is also helpful in controlling haemorrhage. The use of splints in conjunction with direct pressure can be beneficial. In those rare cases where bleeding cannot be controlled by any of these methods, you must use a tourniquet. If bleeding does not stop after a short period, try placing another compress or dressing over the first and securing it firmly in place. If bleeding still will not stop, try applying direct pressure with your hand over the compress or dressing.

Remember that in cases of severe haemorrhage, it is less important to worry too much about finding appropriate materials or about the dangers of infection. The most important problem is to stop rapid exsanguination. If no material is available, simply thrust your hand into the wound. In most situations, direct pressure is the first and best method to use in the control of haemorrhage.

Pressure Points

Bleeding can often be temporarily controlled by applying hand pressure to the appropriate pressure point. A pressure point is the spot where the main artery to an injured part lies near the skin surface and over a bone.

Apply pressure at this point with the fingers (digital pressure) or with the heel of the hand. No first aid materials are required. The object of the pressure is to compress the artery against the bone, thus shutting off the flow of blood from the heart to the wound. There are 11 principal points on each side of the body where hand or finger pressure can be used to stop haemorrhage.

These points are shown in figure 15-23.

If bleeding occurs on the face below the level of the eyes, apply pressure to the point on the mandible.

This is shown in figure 15-23 A.

To find this pressure point, start at the angle of the jaw and run your finger forward along the lower edge of the mandible until you feel a small notch.

The pressure point is in this notch. If bleeding is in the shoulder or in the upper part of the arm, apply pressure with the fingers behind the clavicle. You can press down against the first rib or forward against the clavicle; either kind of pressure will stop the bleeding.

This pressure point is shown in figure 15-23B. Bleeding between the middle of the upper arm and the elbow should be controlled by applying digital pressure to the inner (body) side of the arm, about halfway between the shoulder and the elbow.

This compresses the artery against the bone of the arm. The application of pressure at this point is shown in figure 15-23C.

Bleeding from the hand can be controlled by pressure at the wrist, as shown in figure 15-24D. If it is possible to hold the arm up in the air, the bleeding will be relatively easy to stop. Figure 15-24E shows how to apply digital pressure in the middle of the groin to control bleeding from the thigh. The artery at this point lies over a bone and quite close to the surface, so pressure with your fingers may be sufficient to stop the bleeding. Figure 15-24F shows the proper position for controlling bleeding from the foot.

As in the case of bleeding from the hand, elevation is helpful in controlling the bleeding. If bleeding is in the region of the temple or the scalp, use your finger to compress the main artery to the temple against the skull bone at the pressure point just in front of the ear. Figure 15-23G shows the proper position. If the neck is bleeding, apply pressure below the wound, just in front of the prominent neck muscle. Press inward and slightly backward, compressing the main artery of that side of the neck against the bones of the spinal column.

The application of pressure at this point is shown in figure 15-23H. Do not apply pressure at this point unless it is absolutely essential, since there is a great danger of pressing on the windpipe, thereby choking the victim. Bleeding from the lower arm can be controlled by applying pressure at the elbow, as shown in figure 15-23I.

As mentioned before, bleeding in the upper part of the thigh can sometimes be controlled by applying digital pressure in the middle of the groin, as shown in figure 15-23E. Sometimes, however, it is more effective to use the pressure point of the upper thigh, as shown in figure 15-23J. If you use this point, apply pressure with the closed fist of one hand and use the other hand to give additional pressure.

The artery at this point is deeply buried in some of the heaviest muscle tissue in the body, so a great deal of pressure must be exerted to compress the artery against the bone. Bleeding between the knee and the foot may be controlled by firm pressure at the knee. If pressure at the side of the knee does not stop the bleeding, hold the front of the knee with one hand and thrust your fist hard against the artery behind the knee, as shown in figure 15-23K. If necessary, you can place a folded compress or bandage behind the knee, bend the leg back, and hold it in place by a firm bandage.

This is a most effective way of controlling bleeding, but it is so uncomfortable for the victim that it should be used only as a last resort. You should memorize these pressure points so that you will know immediately which point to use for controlling haemorrhage from a particular part of the body.

Remember, the correct pressure point is that which is (1) *nearest the wound*, and (2) *between the wound and the main part of the body*. It is very tiring to apply digital pressure, and it can seldom be maintained for more than 15 minutes. Pressure points are recommended for use while direct pressure is being applied to a serious wound by a second rescuer. Using the pressure-point technique is also advised after a compress, bandage, or dressing has been applied to the wound, since this method will slow the flow of blood to the area, thus giving the direct pressure technique a better chance to stop the haemorrhage.

The pressure-point system is also recommended as a stopgap measure until a pressure dressing or a tourniquet can be applied.

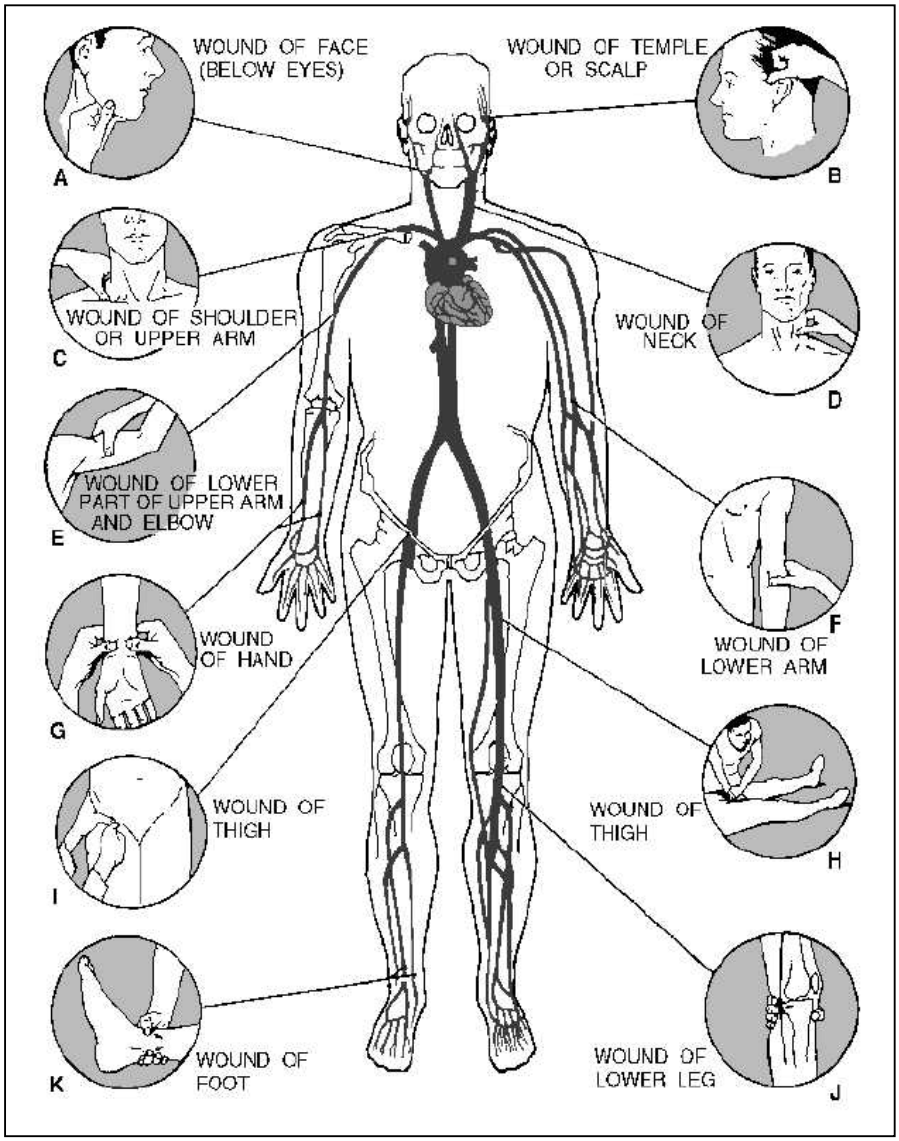


Fig. 15-23 Pressure points

15.2.4 Burns

Types of burn

The severity of your burn depends on how deeply it has affected the skin tissue (see illustration).

There are three types of burn: superficial, partial-thickness and full-thickness.

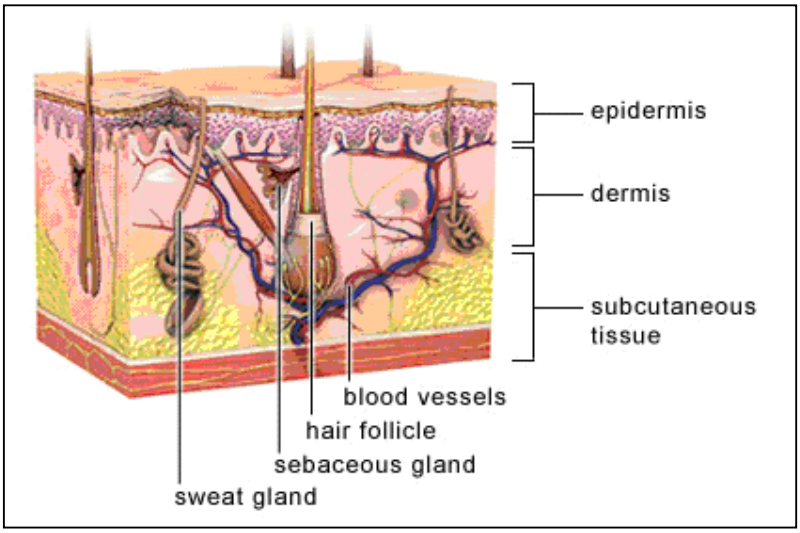


Fig.15-24 The skin tissue

Superficial burns

Superficial burns only affect the surface of the skin (epidermis). Your skin will be red and painful, but not blistered. Mild sunburn is an example of a superficial burn.

Partial-thickness burns

Partial-thickness burns are deeper burns that damage your epidermis and dermis to varying degrees. If the damage to your dermis is shallow, your skin may be pale pink and painful, with blisters. Deeper burns to your dermis will cause your skin to become dry or moist, blotchy and red. Deep partial-thickness burns can be painful or painless and may blister.

Full-thickness burns

All layers of your skin are damaged by full-thickness burns. Your skin will be white, brown or black and dry, leathery or waxy. Because the nerves in your skin are destroyed with full-thickness burns, you won't feel any pain or have blisters.

Symptoms of burns

If you're burned, you may have symptoms such as:

- changes in skin colour - burns can cause pink, red, white, brown and black skin
- blisters
- pain in the burned area - but pain from burns isn't related to severity

Symptoms of an airway burn include:

- burned nose hairs
- soot in your mouth or nose
- change in your voice
- sore throat
- wheezing

Treatment of burns

Treatment for burns depends on their severity.

You can treat *superficial and minor partial-thickness burns* caused by heat at home. However, seek medical help:

- all deep partial-thickness and full-thickness burns
- all chemical and electrical burns
- superficial and partial-thickness burns covering an area larger than the palm of your hand
- burns that cover a joint or are on the face, hands, feet or groin
- all airway or suspected smoke inhalation burns
- advice if you're not sure about the extent of the burn or how to deal with it.

For *full-thickness burns or burns caused by chemicals or electricity*, call for emergency help. While waiting, valuable treatment can be given.

- For burns caused by heat, carefully remove any restricting clothing or jewellery that isn't stuck to the burn. Flood the burn with cool (not cold) water until medical help is available.
- For burns caused by chemicals, remove any affected clothing. Brush the chemical off your skin if it's a dry powder and flood the burn with cool (not cold) water. Don't try to neutralise the chemical with another chemical.

15.2.5 The shock

Causes of Shock

Shock can develop when the heart pump fails to work properly, causing a reduction in the pressure of the circulating blood. The most common cause of this type of shock is a heart attack.

Shock can develop as a result of a reduction in the volume of fluid circulating around the body. The most common examples of this are external or internal bleeding, or loss of other bodily fluids through severe diarrhoea, vomiting, or burns. The blood supply is diverted from the surface to the core of the body. The main symptoms and signs of shock relate to such redistribution of the circulation.

Recognition of Shock

Initially, a flow of adrenaline causes:

- A rapid pulse.
- Pale, grey skin, especially inside the lips. If pressure is applied to a fingernail or earlobe, it will not regain its colour immediately.
- Sweating, and cold, clammy skin (sweat does not evaporate).

As shock develops, there may be:

- Weakness and giddiness.
- Nausea, and sometimes vomiting.
- Thirst.
- Rapid, shallow breathing.

- A weak, 'thready' pulse. When the pulse at the wrist disappears, fluid loss may equal half the blood volume.

As the oxygen supply to the brain weakens:

- The casualty may become restless, anxious and aggressive.
- The casualty may yawn and gasp for air ('air hunger').
- The casualty will eventually become unconscious.
- Finally, the heart will stop.

Treatment of Shock

DO NOT let the casualty move unnecessarily, eat, drink, or smoke.

DO NOT leave the casualty unattended. Reassure the casualty constantly.

- Treat any cause of shock which can be remedied (such as external bleeding).
- Lay the casualty down, keeping the head low.
- Raise and support the casualty's legs (be careful if suspecting a fracture).
- Loosen tight clothing, braces, straps or belts, in order to reduce constriction at the neck, chest and waist.
- Insulate the casualty from cold, both above and below. Contact the emergency service.
- Check and record breathing, pulse and level of response. Be prepared to resuscitate the casualty if necessary.
- Maintain body heat by insulating the victim from the surroundings and, in some instances, applying external heat.
- If wet, remove all the victim's wet clothing as soon as possible and replace with dry clothing.
- Improvise a shelter to insulate the victim from the weather.
- Use warm liquids or foods, a pre-warmed sleeping bag, another person, warmed water in canteens, hot rocks wrapped in clothing, or fires on either side of the victim to provide external warmth.
- If the victim is conscious, slowly administer small doses of a warm salt or sugar solution, if available.
- If the victim is unconscious or has abdominal wounds, do not give fluids by mouth.
- Have the victim rest for at least 24 hours.
- If the victim is conscious, place him on a level surface with the lower extremities elevated 15 to 20 centimeters (6 to 8 inches).

- If the victim is unconscious, place him on his side or abdomen with his head turned to one side to prevent choking on vomit, blood, or other fluids.

15.2.6 Immersion foot

Non-freezing cold injury – Immersion foot

This is a term given to the condition when the temperature of local tissues in the limbs (usually the feet) remains sub-normal but above freezing for a prolonged period. It is commonly encountered by shipwreck survivors who have been adrift and cold for several days. Usually the feet have been wet and immobile, but this injury can occur in dry conditions. Other contributory factors are tight footwear and sitting still with the feet down for prolonged periods.

Diagnosis

Feet become white, numb, cold and frequently are slightly swollen. When returned to the warmth, the feet become hot, red, swollen and excruciatingly painful.

Prevention

Every effort should be made by survivors to keep their feet warm and dry. Shoe laces should be loosened; the feet should be raised and toe and ankle exercises encouraged several times a day.
When possible, shoes should be removed and feet kept warm by placing them under the armpits, but outside the clothing, of another occupant of the life-raft or boat. Alternatively, unwanted spare clothing may be wrapped round the feet to keep them warm. Smoking should be discouraged.

Treatment

After rescue every effort should be made to avoid rapid re-warming of the affected limbs. Care should be taken to avoid damaging the skin or breaking blisters. Do not massage affected limbs.

15.2.7 Freezing cold injury – frostbite

Frostbite is the term given to the condition when tissue fluids freeze in localised areas of the body; the hands, face and feet are particularly susceptible.

Cause

Exposure, particularly of bare skin to sub-zero temperatures, especially when combined with air movement. Look-outs in life rafts or survivors in open boats are particularly prone to this injury. Accordingly, consideration should be given to the length of watch periods and watch keepers should be supplied with any spare clothing.

Diagnosis

The signs are:
- extreme waxy pallor of the skin;

- initial local tingling and stiffness when it is difficult to wrinkle the face or wiggle affected toes or fingers;
- complete absence of sensation in the area affected; and
- local hardness due to freezing of the flesh.

The depth of tissue damage can be graded, like burns, into 1st degree (frost nip), 2nd degree, 3rd degree and 4th degree.

Prevention

If bare skin has to be exposed to the elements, the periods of exposure should be kept to a minimum and freezing winds particularly avoided. Moderate exercise and massage at an early stage will help to prevent the onset of cold injury. Do not smoke; smoking reduces the blood supply to the hands and feet.

Treatment

On detection of the above signs, immediate steps should be taken to re-warm the frozen parts before permanent damage occurs. Get out of the wind. Re-warm the frozen area by applying it to a warmer part of the body, e.g. hands under armpits, cupped hand over cheek, nose, ear, etc.

Once freezing has occurred do not rub or massage affected areas. When treatment has been ineffective the skin dies and becomes black. If this occurs dry dressings should be applied to the affected part.

15.2.8 Heat stroke

What is Heat Stroke?

Heat stroke is the most severe form of heat related illness. Heat stroke is severe injury from high body temperatures that causes damage to many organs, particularly the central nervous system, which include the brain and spinal cord. Heat stroke is a life-threatening emergency. Without proper care, heat stroke victims will most likely die.

People with heat stroke are dehydrated and require re-hydration. The very young and old are very susceptible to the hazards of heat stroke.

Types of Heat Strokes

There are two main types of heat stroke: external and classic.

Exertional heat stroke

People who have exertional heat stroke are usually people who are exercising in excessively warm conditions. Their bodies cannot manage the stress of the physical activity and the hot environment together.

Classic heat stroke

People with classic heat stroke are usually elderly, very young (infants and toddlers) or debilitated people who are in warm environments for too long. The elderly are especially vulnerable to the heat. Elderly people are more

vulnerable to the heat because as the body ages, it is less able to handle heat and cool itself off.

What are the Symptoms of Heat Stroke?

Some of the most common symptoms are: red, flushed skin, fever (body temperature of 106-degrees or higher), seizures, headache, rapid pulse and unconsciousness.

What causes a Heat Stroke?

Some of the most common causes of heat stroke are: high temperatures, lack of body fluids and overexposure to the elements. Heat Stroke does not have to be caused by exercise or exertion.

What happens during a Heat Stroke?

During a heat stroke, your body is unable to properly cool itself. When it is unable to cool itself, the core body temperature rises rapidly.When the core temperature rises, the brain begins to fail. (The brain can only function in a very narrow temperature range). As the brain overheats, the individual will become disoriented, combative, argumentative and may hallucinate.

How is a Heat Stroke Treated?

The main focus of treatment is to lower the body temperature. Different techniques can be used.

Can a Heat Stroke be Prevented?

Heat stroke, like all heat-related illnesses, is preventable. Some of the ways to prevent heat stroke is stay well hydrated, wear cool clothes, and keep cool.

15.2.9 Contamination with oil

Do not clean oil off the skin (except around the mouth and eyes) until the person is warm and comfortable.

Survivors who have recovered from hypothermia can be taken to a warm shower or bathroom and should have all their clothes taken off.

Then their skin should be wiped with soft cloth and strong paper towels to remove as much of the oil as possible. Injured or burned areas should be wiped with care or not at all.

If a strong warm shower is available, mechanical removal of much of the oil can be accomplished by the water jet effect.

Hair shampoo will remove oil from the hair and can be used to help remove oil from the body.

Then, with time, patience, help, and wiping, and using good toilet soap or shower gel to clean the skin, the rest of the oil can be washed away.

Solvents, scouring compounds, kerosene, and other cleaners not designed for skin cleaning must not be used.

It is, however, all right to use jellied cleansing agents that are designed for skin cleaning.

15.2.10 Dehydration and malnutrition

Survivors who have been adrift for several days may be suffering from dehydration. If they have been adrift for several weeks malnutrition may also be a problem.

Caution should be exercised in trying to reverse either dehydration or malnutrition rapidly.

Give sweetened fluids in quantities which will produce a urinary output of one litre per day initially. In temperate climatic conditions (or air-conditioned accommodation) this will usually mean an input of about 2 litres a day. If the weather is warm and the skin is moist or sweaty, higher intakes may be permitted.

Initially, a diet of nourishing liquids (sugar and water or milk or soup) will satisfy nutritional requirements and should be given for the first two days. Then small amounts of normal food can be given additionally. **RADIO MEDICAL ADVICE** should be sought.

This diet should continue until either the survivor can be transferred to care ashore or medical assistance is given on board.

15.2.11 Problems in the lifeboat

Vomiting

This may be due to the unusual motion of the small craft (sea-sickness is inevitable in a life raft), or to swallowing fuel oil or sea water. It is unlikely to continue very long.

After severe vomiting the patient should lie down and be kept warm with coats or blankets. Seasickness tablets may give relief if taken well before the onset of vomiting. They should be issued at the earliest opportunity after entering a life raft.

Constipation

Action of the bowels is not expected when taking little or no food. No treatment is needed for this condition – in fact laxatives will do harm.

Difficulty in urination

There may be some difficulty in passing urine and the bladder may feel uncomfortably full. In any case, not much water will be passed when the drinking ration is small. The urine may appear dark in colour and thick. This is to be expected and need not cause alarm.

Swollen legs

Swelling of the legs is a common occurrence in the boat and continues for a few days after rescue. The condition subsides without treatment and, by itself, is a matter of no importance but can be partially relieved by the exercises recommended for immersion foot.